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THE NECAXA TRANSMISSION PLANT.

Our leading article this week deals with the great power transmission system that is just being finished for work around the City of Mexico. It is notable not only for its size, which is initially 30,000 kw, and likely to be doubled, but for some bold construction features of rather exceptional interest. To begin with, it involves the diversion of one stream to join with another in the formation of an artificial storage lake three square miles in area retained by a dam 177 ft. high. This construction is a remarkable feat in itself in its magnitude. More and more as time goes on this matter of artificial storage becomes important. Without it the available power of a stream approximates to the minimum rather than the average flow. In regions which are damp and well wooded even the minimum flow is not to be despised, as it is a reasonably large fraction of the average; but in a dry and sparsely forested district the minimum flow is degraded into insignificance and any serious effort at power development must depend on storage. Every bit of water at high head is valuable, and storage becomes not only very valuable but relatively easy. In many regions it is being studied and practised even to the extent of storing practically the whole year's rainfall, and the Necaxa storage system may be regarded as typical of modern necessity in hydraulic engineering.

The electrical plant, too, is possessed of very unusual features, particularly in its use of vertical shaft generators driven by impulse wheels. The reason for this construction is not altogether obvious, since it involves some unusual precautions in the matter of bearings, without any especial gain. The voltage of the generators, too, is unusual, although probably justified in view of the local distribution, and the frequency of 50 cycles, although standard continental practice, is exceptional in plants on this side the Atlantic. Probably considering the length of the proposed transmission and the existing load to be supplied, the lowered frequency is well chosen, in fact in itself preferable to the usual 60 cycles. We shall be interested in the performance of the wheels, which are of foreign make and unusual construction. Regulating nozzles under the head in use at Nacaxa involve some very nice engineering details, and we shall be glad to learn of their successful operation as a rebuke to the bad habit of throwing away water quite unused. The exciter equipment is out of the ordinary in including both wheel-driven and motor-driven exciters. Just what the special function of the latter is to be we fail yet to see. They have an obvious economic value in a steam-driven station, but of all prime-movers, impulse wheels probably show the smallest gain in efficiency with increasing size, so that the motor driving scheme seems somewhat peculiar till explained.

In the transmission lines the engineers have pushed the tower plan of construction to its limit and therefore Necaxa will be a good plant to watch. With complete duplicate tower lines there should be little difficulty in preserving a high degree of continuity of service. The long spans thus secured certainly are useful in reducing the number of points to be insulated. In working at 60,000 volts the more insulators the more trouble. It therefore behooves one to be particularly sure of his insulators, especially on a tower line where a broken insulator is pretty certain to shut down the circuit on the spot. The insulators for this plant are of good appearance, but the test reported of 120,000 volts for a 60,000-volt plant is most certainly too low to insure an adequate factor of safety. If the line is regularly to be worked at 60,000 volts the insulators

ought to be able to stand up at 150,000 and preferably at 180,000. It has been pretty well shown by experience that 2 is too small a factor of safety for the insulators on an overhead transmission line. We expect that the margin in fact will prove to be better than is assured by the tests. A big plant located so far from its base of supplies as is Necaxa must be almost fitted up for manufacturing purposes, so that the complete machine shop equipment becomes here a matter of necessity, and there must also be rather complete provisions for electrical repairs upon a large scale. So important a plant as this is likely to be a powerful factor in industrial development and must prove of particular value in enabling the El Oro gold fields to utilize the full advantage of the most modern methods and machinery. The vicinity of the City of Mexico is a most favorable region for the transmission of power, and with the advent of current from the Necaxa plant Mexico should be one of the most thoroughly "electrified" cities in the world. The plant is particularly fortunate in securing Mr. Hayward as general manager. It is a place where his long experience in high-voltage work can be utilized with most telling effect.

FREE LAMP RENEWALS.

When at the meetings of State electric light associations the subject of free lamp renewals is brought up, the general lack of sympathy with the idea on the part of the smaller central stations is made clearly evident. Probably a partial reason for this attitude is that the advocacy of free renewals has formed part of the business policy of some lamp manufacturing companies, thus giving rise to a suspicion that reduction of selling and other expenses on the part of these, rather than increase of profit to central stations, is the real motive which has prompted such companies to enter the domain of central station economics. Whatever truth there may be in this presumption, the facts remain that all of the larger central stations of the country have definitely adopted the policy of free lamp renewals, and there are excellent central station business reasons in its favor regardless of the size of the central station. The argument against the policy of free lamp renewals, as set forth by managers of smaller central stations, is that its adoption means an increase in expense without any tangible return. The weakness of this argument lies in the fact that it neglects factors which, though not apparent at a casual glance, yet very materially affect central station returns. Central stations are in the business of competing in the field of illumination with kerosene, gas, gasolene and acetylene gas, and there is not a central station in the United States but has some such competition. What the central station is attempting to deliver is light, and by users and prospective users the company is judged by the light it furnishes for a given amount of money. The kerosene lamp is a very serious competitor of the small central station because the amount of light it gives for a given expenditure is very large. In the small town Mr. A, who has kerosene lamps in his house, will compare the quality of his illumination and cost thereof with Mr. B, who has electric lights, and it is easily seen that a central station company whose circuits are filled with a lot of inefficient lamps purchased by customers of hardware dealers under guarantees of long life and giving perhaps half-rated candle-power, is likely to suffer severely in such comparison. The competition to be met by the electric light companies in the large cities against Welsbach burners and "gas arcs" is as nothing compared to the competition of good, efficient kerosene lamps and gasolene plants in the smaller towns where pennies count for more than they do in the cities.

To meet this situation the small central station is called upon to give the very best light possible for the money, to see that its customers have their lights placed to the best advantage and equipped with good reflectors or globes where such are needed, and that the lamps are burned at a good candle-power. There seems to be no feasible way of attaining this end except by taking the renewals of lamps out of the customers' hands and furnishing them high-efficiency lamps free. If a customer has to buy his lamps he will buy them at the cheapest place. Frequently the sale of lamps drifts into the hands of local merchants, who sell cheap low-efficiency lamps, which the customer thinks are ideal because they last so long without burning out. If the company attempts to control the matter by selling customers lamps at a little below cost, it may run into the difficulty that with high-efficiency lamps customers are likely to complain of the short life obtained, and the local merchant selling low-efficiency lamps may even be able to convince them that "It pays to pay a little higher price and get a better lamp, because it will last so much longer!" It is extremely difficult to make customers see that the high-efficiency lamp is the cheapest one for them to buy when cost of power is counted. While the method of selling high-efficiency lamps to customers by the company at a little below cost is much better than no attempt to control the lamps which go on circuit, much the more satisfactory way for all concerned is to take the whole matter out of the customers' hands, even going to the extent of renewing all lamps which are burning dim or which the customer thinks are not up to proper brightness. A boy with a cheap photometer can test hundreds of these returned lamps in an hour, and if they have not fallen below a certain candle-power they can be returned to service later. In this connection it may be pointed out that the commercial success of the Nernst lamp was greatly accelerated by the adoption of the policy of maintenance by central stations instead of leaving the maintenance to the customers and local supply houses. This question of free lamp renewals is one of the many which are becoming vital to the central station under the present-day central station business situation. The period of development is rapidly drawing to a close, and business questions which in the past were dismissed with generalities as to "local conditions," etc., must now be faced by managers who wish to feel secure in their positions.

SUBMARINE AND SUPERMARINE TELEGRAPHS.

The recent completion of another submarine cable across the Atlantic, as announced in our columns recently, emphasizes the opinion of those who conduct intercontinental telegraph traffic that wireless telegraphy across wide oceans is not yet an earnest competitor with the cables. Nevertheless, an ocean cable costs more than a thousand dollars per mile; whereas a wireless telegraph system has only to expend money upon terminal plants, the circumambient ether being still rent free.

The fact is that the volume of telegraphic traffic between different parts of the world is so great that no single circuit can handle it. Even if wireless communication were established between a pair of stations across the Atlantic, this would only be the equivalent, at present, of one cable circuit worked simplex; whereas there are now more than a dozen transatlantic cables working duplex. Since these have cost collectively many millions of dollars, it is clear that they have only been laid as a matter of commercial necessity. It will be necessary for wireless telegraphy to be able to send not only one stream of messages across the Atlantic, but a number of coincident or simultaneous streams of non-interfering messages, before the cable will be unable to earn a livelihood.

It is early yet to predict the future lying before wireless telegraphy. It is only a few years old, while wire telegraphy is nearly a century old, if we consider experimental work, and seventy years

old if we consider only commercial work. Already wireless telegraphy has come into commercial use in places where cable telegraphy has been placed at a disadvantage. Whatever be the distant prospect of wireless telegraphy, we may be certain that in the near future it will greatly aid and supplement wire telegraphy. When the electric light came into the field of illumination it did not extinguish gas lighting, as some had feared. It has won and occupied its special field. Similarly, wireless telegraphy will have a large field to cover in placing vessels at sea in electric communication with the land. Gradually, with the progress of the wireless art, we may expect to see longer distances covered in competition with cables; but for years to come we may expect to see the wireless masts bring messages to the great intercontinental cable system of 230,000 miles total length, far more frequently than they rob the cables of messages.

Air-Gap Reluctance.

The *Journal* of the Western Society of Engineers has recently published a paper by Mr. C. H. Smoot, Jr., abstracted in the Digest, upon the subject of air-gap reluctance in dynamos, as determined experimentally through the medium of an electric analogy. An able mathematical article by Mr. F. W. Carter appeared in our issue of November 30, 1901, in which formulas were derived for the computation of the reluctance in any air-gap of known dimensions employing slotted cores. It is well known that the computation of the air-gap reluctance in a smooth-cored armature is very simple. The gap is treated as a plane slab of known length, breadth and uniform thickness. Consequently, the reluctance of the slab, expressed in oersteds, is equal to the thickness of the slab in centimeters divided by the area in square centimeters. When, however, there are slots in the armature core, which is usually the case in modern dynamo-electric machines, the computation is made much more difficult, and was beyond engineering reach a few years ago. Various formulas of approximation were in use, but it was usually considered necessary to depend upon experimental measurements of the reluctance in dynamos, by means of the voltage characteristic observed at low-field excitation, and when the reluctance in the iron of the field and armature might be considered very small compared with the reluctance in the air-gaps.

In November, 1904, a paper on the subject was read by Messrs. Hele-Shaw, Hay and Powell before the British Institution of Electrical Engineers. These gentlemen made an experimental study of the subject with the aid of hydrodynamic models, checking the results by electromagnetic search-coil measurements on actual machines and by the Carter formula. The hydrodynamic method they employed is very beautiful, but calls for great experimental skill. A thin water chamber was formed between a pair of parallel glass plates, and sealed with wax, in such a manner that water could be forced through the chamber in a direction parallel to the glass walls. The flux of water would, of course, be invisible to the unaided eye, but by introducing small spaced jets of colored water into the plain water stream at the entrance, the lines of water flux or stream lines appeared as alternate bands of clear and colored fluid between the glass walls of the chamber. Further, by employing very thin films of water flux between layers of wax on the glass walls, to represent air-gaps or slots, and much thicker films of water where the wax was cut away, to represent the magnetically conducting iron pole-piece or armature teeth, beautiful photographs of the water flux were presented, to correspond with the invisible magnetic flux in dynamo air-gaps of definite dimensions selected from practice. A very satisfactory agreement was found to exist between the air-gap reluctances computed from the photographs of the water flux and those obtained by the Carter formula. The hydrodynamic method of experimenting has the advantage that it is not limited to straight air-gaps corresponding to dynamo-armatures of indefinitely large diameter; but is just as readily applicable to curved air-gaps bent to the circumference of ordinary dynamo-armatures. Moreover, the flux is made immediately visible to the eye, and the photograph of the stream lines is permanent. On the other hand, the total number of streams that can be brought into action in the hydrodynamic model is necessarily limited.

Hele-Shaw, Hay and Powell presented a table comparing a number of air-gap correction coefficients for slots of various dimensions, by the water stream line method and by the Carter formula. These correction coefficients are in very fair mutual agreement. They vary between 1.1 (for the case of a narrow slot and long air-gap) and 2.0 (for a wide slot and narrow air-gap). That is, the reluctance of the air-gap is increased by the slotting of the armature, by amounts varying in different practical cases from 10 per cent to 100 per cent. The average coefficient is 1.31, corresponding to an increase in reluctance of nearly one-third, due to slotting. Another reluctance of the air-gap of like dimensions due to the slotting. In has been either used or suggested for a number of years is that of measuring the electrical resistance of a thin strip of metal, such as sheet iron between two copper electrodes applied to its surface, one shaped like a pole-piece and the other like the slotted armature. The increase in electric resistance due to the slotting of the armature electrode would be numerically the same as the increase in magnetic reluctance of the air-gap of like dimensions due to the slotting. In practice, however, it is difficult to establish sufficiently good contact uniformly over the contour of the copper electrodes where they rest on the sheet of iron. But it was suggested in the article of Mr. Carter, already referred to, that a better plan would be to cut the sheet with shears into the form of the air-gap, including slots, and to make contact with the electrodes along the edges of the sheet which correspond to the straight flux paths midway between adjacent poles. The resistance of the strip would then be a measure of the magnetic permeance of the air-gap including slots, while equipotential surfaces on the strip explored and delineated with the aid of a potentiometer, would correspond to the stream lines, or magnetic flux paths of the actual case.

This suggestion has been carried out by Mr. Smoot, who has given in tabular form a number of correction coefficients, compared with those obtained from the hydro-dynamical model and also with those of the Carter formula. All three series seem to be in satisfactory agreement, and conjointly leave little doubt as to the approximate correctness of each. In many cases the flux density carried in the teeth of the armature is brought almost to the saturation limit, and thus a new element of complexity is added to the situation, because if the teeth were completely saturated their reluctivity would be the same as that of air, and the air-gap correction would become markedly increased. In the experimental method using the electric strip model, the fact that the edges of the slots terminate in the non-conducting air shows that the teeth are assumed to have indefinitely large magnetic permeability. In the Carter formula also the magnetic permeability of the teeth is assumed to be indefinitely great. An appreciable discrepancy is, therefore, to be looked for between the observed and computed reluctance of the air-gap over a slotted armature, when the flux density in the teeth is pressed to a high limit. The hydro-dynamic experimental method alone permits of this saturation correction being applied, since the thickness of the film of water in the regions representing the teeth can be narrowed down to a proper value suited to the permeability in the teeth if that permeability can be determined from independent data. Nevertheless, the attempt would probably involve much difficulty, and perhaps practical requirements never call for such a degree of refinement in the determination of air-gap reluctance.

The Single-Phase Plans of the New Haven Railroad.

Last week we presented an important communication from Mr. Frank J. Sprague with regard to difficulties involved in the operation of the single-phase electric locomotives of the New York, New Haven & Hartford Railroad in the direct-current zone and double-decked terminal depot of the New York Central Railroad, at Forty-second Street. We are now favored with the subjoined comment from Mr. Calvert Townley, consulting engineer and assistant to the president of the New Haven road:

It is not my feeling that the arguments for and against the respective plans of the New York Central & Hudson River Railroad Company and the New York, New Haven & Hartford Railroad Company for the electrical handling of their traffic into Forty-second Street can be discussed with profit in the columns of the press, between the engineers of the two companies; neither is it my purpose to reply to Mr. Sprague's comprehensive arraignment of the policy and manners of the New Haven road.

However, as the inference may be drawn that the public is to be incommoded, and the prosecution of a great engineering improvement hindered by the action of the New Haven road in declining to absolutely follow the engineering lead of Mr. Sprague and his associates, I cannot let the article pass unnoticed.

On that score it is proper to point out that the locomotives which have been purchased by the New Haven road will handle that company's trains between Forty-second Street and Woodlawn, receiving continuous current from the third rail in exactly the same manner as it is proposed that the locomotives purchased by the Central Company will handle the trains of that company, and inasmuch as the stub-end track facilities of the enlarged Forty-second Street station will be largely increased over similar facilities afforded by the present station, and inasmuch as these increased facilities will be relieved of a considerable number of the present trains of the Central Company, by transfer to the suburban loop, it is difficult to find reason for alarm at prospective delays or lack of accommodations to the traveling public, or on behalf of the Central Company for inharmonious operation.

That the progress of the art of locomotive design since the purchase of the locomotives adopted by the Central some two years ago has enabled the New Haven road to procure a type which, in addition to operating on the Central's continuous system, is also capable of operating on a single-phase, alternating current, thus widening the possible application of electric traction for future extensions on the New Haven's electrical system, should be a source of gratification rather than of censure or alarm.

Mr. Sprague's unfamiliarity with the up-to-date development of electric locomotives has, perhaps, led him into his dire prognostications of disaster, and while, under the circumstances, an extended argument can be of little avail, I have no doubt that the management of the New Haven road will be quite content to await the practical results which will very soon furnish substantial evidence of the correctness or error of its judgment.

Kansas Gas, Water, Electric Light and Street Railway Association.

The eighth annual meeting of the Kansas Gas, Water and Electric Light and Street Railway Association was held in the Mercantile Club Room, Kansas City, Kan., on October 13 and 14. The secretary's report showed that the total membership on October 13 was 94, including honorary, active and associate members.

Papers on the following subjects were read and discussed: "The Tantalum Lamp," by Prof. B. F. Eyer; "Public Utilities and Municipalities," by Prof. E. H. Bailey; "The High Efficiency of High-Candle-Power Lamps," by J. F. Shaefer; "The Need of Sewage Disposal in Kansas," by R. E. McDonnell; "Co-Operation in Management of Gas, Water, Electric Light and Street Railway Companies," by C. R. Maunsell; "Relative Heat-Producing Values of Natural Gas, Oil and Coal," by Prof. Erasmus Haworth.

In his paper on "Public Utilities and Municipalities," Prof. E. H. Bailey stated that, according to a recent report, there were in the United States the following number of water works, gas plants and electric light plants, of which the indicated per cent were owned by the cities in which they were located:

	Total number.	Owned by Municipality.
Water works	3,326	53.7 per cent.
Gas plants	965	1.5 per cent.
Electric light plants	3,032	15.2 per cent.

The large cities in which at the time of the report the water works were owned by private corporations were: San Francisco, Indianapolis, New Haven, St. Joseph, Patterson, Omaha and Scranton. In almost all cities the sewage plants or sewage purification works are owned by private corporations, and such is of necessity the case, on account of the material which they handle, and the importance of the Board of Health having control over the plant as a whole.

It is evident that the tendency to advocate public ownership of the public utilities is due partly at least to the fact that private corporations have not in the past done their best to supply these necessities at a fair rate of compensation, and of good quality. A recent editorial in the Kansas City *Times* upon the railway situation, which treats of this phase of the government ownership problem, was given by Prof. Bailey as follows: "It is a remarkable thing that the railway world, which contains some of the ablest men in the country, should still be so indifferent to the growth of the sentiment favorable to safe and effective regulation, to the elimination of railway influences from politics and to the establishment of the square deal generally between the shipping agencies and the shipper. The systematic opposition of the railways to the proposed rate regulation, to the building of the Panama Canal, to measures designed to abolish the legislative lobby and to all other reasonable efforts to establish an open, frank, business-like system, free from corruption and favoritism, these are manifestations of singular short-sightedness. Those who deplore government ownership, or the agitation of it, should be foremost in encouraging all reasonable steps to avoid it. The present policy of the railroads is directly in line with the promotion of extremely radical agitation. The people, once they are aroused, must be met with fairness or they will go to extremes. That is not a matter of conjecture. It is a matter of human nature, demonstrated by abundant precedent."

From the standpoint of a layman, then, it seems desirable for the private company to give the very best possible service for the money. Using the gas company as an illustration, it may be stated that the gas should be delivered under the proper pressure and should be of the best quality. It is worth while for the superintendent to be something of a scientific man in his way, and for him to make reasonable efforts to prove to customers the value of the gas for heating and lighting, to show that the best approved scientific methods have been used to make it pure and suitable for use as a lighting or heating agent. Let him show, if he deals in natural gas, that it is even better as a heating agent than the artificial gas; that the natural gas cannot be burned in the ordinary fish-tail burner, and why this is true. A little information of this kind will prevent a considerable number of complaints from ignorant people and will make the public friendly rather than inclined to find fault with everything.

Less can be said in this line in regard to electric light service, but even here there is a chance to make the service the best; to keep a steady e.m.f.; to educate the people to use electricity for power, and in some special cases for heating.

In the case of street railways there are so many things that go to make what is called "good service" that they cannot here be enumerated. The fact is that the supply of gas, water and electric lights to the people must be upon a different basis from the supply of potatoes, furniture or neckties. In the latter field, if the goods are inferior, we take them back or get a rebate, or patronize some other house, but when we do not find the gas or water or electricity satisfactory, we are told that "we can go without"—when the company know that usually we cannot go without. Since the corporation that has these necessities to sell has the advantage it would be the best policy to meet the public half way, even at the temporary loss of a little revenue.

The following officers were elected for the coming year: President, W. E. Sweezy, Junction City; first vice-president, S. W. Sterrett, Kansas City; second vice-president, F. B. Aley, Wichita; third vice-president, C. L. Brown, Albine; secretary and treasurer, James D. Nicholson, Newton. The next meeting will be held in Lawrence, Kan., the latter part of October, 1906.

Electrical "Open Shop".

Advices from Boston state that a new organization known as the "Open Shop" Electrical Contractors' Association of Boston and Its Vicinity has been formed. It started with only about twelve members and its formation was announced to the other employers through a letter, which was sent to all the electrical contractors in the district. Part of the communication follows:

Boston, Mass., October 6, 1905.

Dear Sirs:—On October 3 the "Open Shop" Electrical Contractors' Association of Boston and Its Vicinity was organized, Herbert S. Potter being chosen president and W. E. Clark secretary.

The objects of the association are to assist and protect its members against the encroachments of labor unions, and to promote a bond of good-fellowship among its members, which has always proved so beneficial in the past to all organizations where a united action was necessary to nullify the corrupt effect of an opposing one.

There are over 90 electrical contractors in Boston and vicinity, more than 80 of whom will declare for the "open shop." It only requires the united action of the "open shop" contractors to compel the members of the union to work in peace and harmony with our men when they come in contact with one another in the execution of their duties, which is all we ask.

It costs only your presence and co-operation at our meetings to belong to this association. Our officers serve without salary, and the rooms and other privileges of the Employers' Association, 88 Broad Street, are open to us free of charge, consequently you will not be called upon to pay dues or assessments.

Frederick A. Swan, Chairman,
Committee of Ways and Means.

Mr. Swan, who is treasurer of the Swan Electric Company, says that the response to this letter is most encouraging to the movement, 52 contractors having joined the association up to last week. He claims that they represent 50 per cent of the employers and about the same proportion of the workmen, and he says the reason that there are so few electrical workers out on strike to-day is that they have remained loyal to their employers and left the union. The idea of forming an open shop association was conceived at the time Boston Union, No. 103, of the International Brotherhood of Electrical Workers of America, presented its agreement for a renewal. The employers felt so limited under the terms of that agreement that they decided not to sign it, after the matter had been discussed in a joint committee of the union and the employers. Some of the largest contractors did sign, but it is said that they are large contractors only in the sense that they employ a large number of men during limited periods, while wiring a new building for example, and then let them go. On October 9 the new association had a second meeting at the office of the Employers' Association and had a large attendance.

In view of the difficulty that the members of the new association might experience in getting workmen if their old employes should strike, an appeal for assistance was made to the Employers' Association, and it is said that Albion P. Pease, the secretary of the association, communicated with electrical contractors in Philadelphia, Springfield, New York, Worcester, Lynn, Portland and many other cities, requesting them to refer to Boston such applicants for work as they may not need, with the result that numerous applications from outside cities reached Boston. Some of the applicants are now employed here. But pending the developments along this line, the "open shop" contractors who joined the new association helped each other by exchanging men as emergency arose. In one shop where there were twelve union men employed three men struck, remaining loyal to the union, and nine gave up their membership in the unions to stand by the employer on his assurance that he will never again sign any agreement with any union and will give them work as long as he is in business. As a general assurance of continued employment for the workmen who declined to strike, but remained in the "open shops" the new association compiled a list of all the "open shops" in Boston and vicinity and had them posted in those shops, showing where the men may obtain employment, and from the Employers' Association on Broad Street a list was secured of "open shops" all along the line from Portland to Philadelphia.

Independent Telephone Affairs in Indiana.

The first meeting of the Indiana Independent Telephone Association of the Eighth District, composed of Rush, Fayette, Franklin, Henry, Union and Wayne Counties, was held in Rushville October 20, Vice-President A. C. Lindermuth, of Richmond, presiding. "Operating Conditions" was the principal subject discussed. Resolutions were passed to the effect that the independent telephone companies in the eighth district are to refrain from any further joint service with any company that has a connection, direct or indirect, with any sub-licensee company of the Bell Company. It was stated that there are few Bell telephones in the eighth district, while there are 11,000 independent telephones, or ten to one of the Bell Company. The meeting was attended by representatives of 35 companies. C. S. Norton, secretary of the State Association, says the plan of organizing the districts is working well, and before the end of next year Indiana will have the strongest Independent Telephone Association in the country.

Important Telephone Deal in Indianapolis.

After several days of strenuous effort upon the part of two parties for the control of the Indianapolis Telephone Company and the New Long-Distance Telephone Company, it may be safely stated that the properties have passed to the control of a syndicate composed of James S. Brailey and others, of Toledo, Ohio, and Col. Breckinridge Jones and others, of St. Louis, Mo. There is some difference of opinion as to which party—the Toledo or the St. Louis—got the larger end of the stock, but that matters but little since they will act in harmony in the management of the companies.

The passing of control in these properties is regarded as the most important and beneficial thing that could have happened to the independent movement in Indiana. In addition to the properties involved being valuable and profitable, they formed important links to the great system now being organized between the Eastern cities and the Western cities, with St. Louis as an important point. With this change of control will come a more aggressive policy, needed improvements and extensions which will greatly benefit the independent movement. It is expected that the reorganization of the companies will be brought about within a short time. There will be no amalgamation of the Home Telephone Company, of Toledo, and the Kinloch system, of St. Louis, with the Indiana property. The new company will be entirely independent of these, notwithstanding the new stockholders are largely interested in those companies. The Kinloch Company's lines already extend into Indiana as far as Terre Haute and the Home, of Toledo, has lines into Fort Wayne. The men now in control say there is no intention to form a merger, it is simply a combination for better service and the closing up of every loop-hole open to inroads upon the part of the Bell Company.

The New German Tariff.

The "Monthly Summary of Commerce and Finance," for August, issued by the Department of Commerce and Labor, through its Bureau of Statistics, contains the complete German customs tariff, giving a comparison of the rates of import duty levied in Germany under the old and the new customs tariffs, respectively. The rates are all expressed in marks per 100 kilos, since no ad valorem duties are levied in Germany.

Since the significance of a given rate of duty, however, appears more clearly when expressed in terms of ad valorem rates, a table has been compiled by the Bureau of Statistics, in which the rates of duty at present levied in Germany on the principal articles of export from the United States are expressed in terms of ad valorem rates, based on the German estimates of the import value of those articles in 1903, the latest year for which figures are available.

These rates are followed by figures indicating the per cent of increase the present rates of duty will undergo in the new general and conventional tariffs, respectively. The German rates of duty being fixed specific amounts, it is evident that the estimated ad valorem rate will fluctuate from year to year in an inverse ratio to

the value of the product; that is to say, as the price of a given article will rise the estimated ad valorem rate will appear as a smaller percentage, and vice versa.

As regards manufactures, the old rates are for the most part moderate. The duty on sewing machines, representing the highest ad valorem rate under the existing tariff among important articles of export from this country, viz.: 22 per cent, is raised 46 per cent (i. e., to about 32 per cent ad valorem) under the new general tariff, no provision having been made under the conventional. Agricultural machinery, which pays on the average about 4 per cent ad valorem, will be subject to rates from 20 per cent to 88 per cent higher (according to the weight of the machine), so that the ad valorem rate under the new general tariff will range from about 5 per cent to 15 per cent, with no provision for conventional rates. The rates of duty on steam engines and motors of all kinds, which were hitherto the same as that on agricultural machinery, and averaged 4 per cent ad valorem, are advanced all the way from 40 per cent to 1,150 per cent (according to weight) in the new general, and from 40 per cent to 837 per cent under the new conventional tariff. In other words, motive machinery, coming from countries not enjoying the conventional rates will be subject to duties as high as 50 per cent ad valorem, while that coming from favored nations will pay duties ranging from 5½ per cent to 35 per cent ad valorem.

Production and Use of Platinum.

Platinum is in extensive use in the electrical arts, and data as to its production are of interest. The war between Russia and Japan is probably responsible for the fact that the output of platinum in the United States increased from 110 ounces in 1903, valued at $2,080, to 200 ounces, valued at $4,160 in 1904. Owing to anxiety in regard to the fate of the platinum industry in Russia, the price of platinum rose about 10 per cent during 1904. "It should not be understood," says Dr. David T. Day, of the United States Geological Survey, in a recent report on the production of platinum and allied metals in 1904, "that the slight rise of 10 per cent in the price of platinum would serve as any great stimulus to the placer gold miners of the West who furnish the platinum products of the United States, for these miners are comparatively indifferent to a slight change in price. The scarcity of platinum and the consequent rise in price, however, led to much energy on the part of Eastern smelters of platinum in urging upon the placer miners of the West the advisability of saving platinum in cleaning up the hydraulic mines. The increase thus effected is interesting as showing what is possible in the United States in the future."

In the opinion of Dr. Day the outlook for increased production for the year 1905 is good, not only on account of the continued high price of platinum, but because of the investigation undertaken by the Geological Survey of the black sands of the Pacific slope (noted recently in these columns) and of the increased knowledge thus furnished to the miners in regard to the value of the platinum and to simple means of saving it.

The world's total supply of platinum for the year amounted to about 300 kg., or 9,625 troy ounces from South America, and 6,000 kg., or 192,500 troy ounces from Russia. No production of platinum from Australia was reported. A slight product of both platinum and palladium from the Sudbury copper mines continues to come on the market, but it is not profitable to extract all of the platinum and palladium which these ores could furnish. Increased interest in the occurrence of platinum in hydraulic mines and dredges of the Fraser River is due principally to the fact that the natural alloy of iron and nickel previously found in Josephine County, Ore., and in Del Norte County, Cal., has also been found in commercial quantity in the Fraser River at Lillooet. An interesting and new occurrence of platinum in places in Sumatra has been noted by Prof. L. S. Hundeshagen. All the American platinum came from California and Oregon, inasmuch as operations have been suspended in the Rambler copper mine, Wyo., which furnished some platinum the year before.

The imports of platinum into the United States during 1905 showed a decline of more than 8,000 ounces due to European control of the supply, which also, of course, aided the rise in price. The present prices are the highest that platinum has commanded in recent years.

Fifth Avenue Stages, New York City.

The difficult problem of placing automobile vehicles on the famous Fifth Avenue thoroughfare, New York City, as substitutes for the horse omnibuses, has again been attempted recently, and we

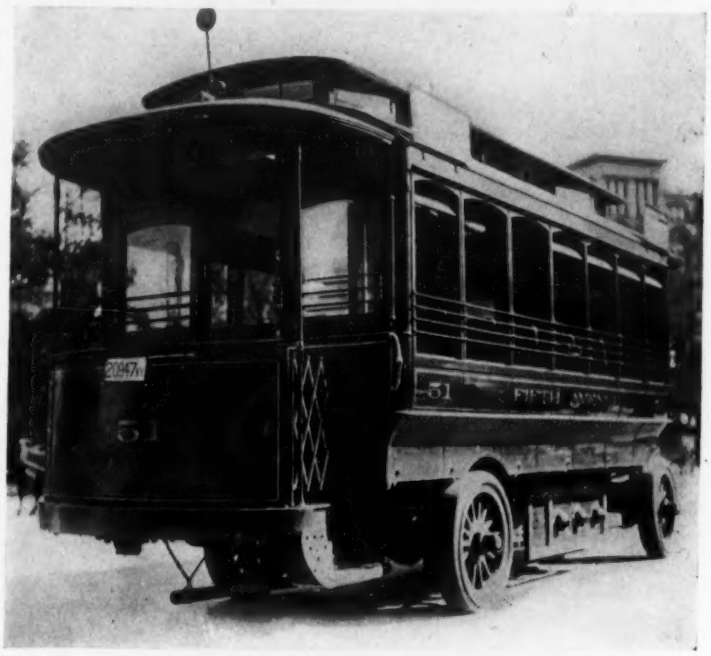


FIG. 1.—AUTOMOBILE STAGE.

illustrate herewith the interesting composite vehicle now in operation as an initial experiment with that type. Figs. 1 and 2 show this stage coach, in the production of which several well-known companies have collaborated.

This vehicle is equipped with two General Electric 1002 motors,

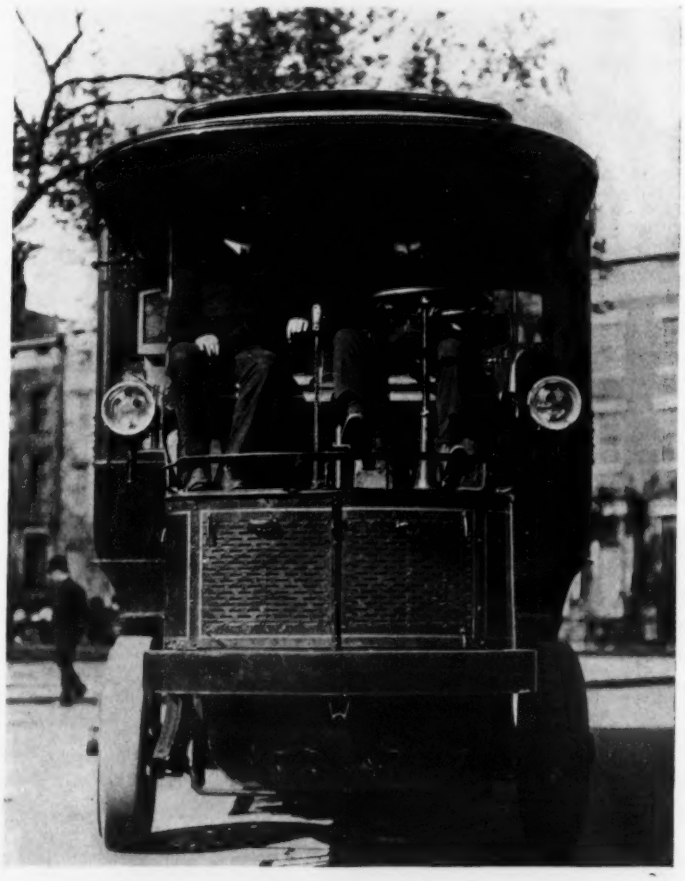


FIG. 2.—AUTOMOBILE STAGE, FRONT END VIEW.

current for which is obtained from a General Electric generator direct connected to a 40-hp Speedway gasoline engine built by the Seabury Co. The car body was built by the J. G. Brill Co., of

Philadelphia, and the construction work and the chassis are due to the Vehicle Equipment Co., the assembling work, etc., being done at their Long Island City plant. The motors, hung under the frame, drive the rear road wheels by means of sprockets and chains. Beneath the body is a battery box which carries two 10-cell sets of Exide storage batteries. These batteries can be used for starting the engine as a matter of convenience by connecting them with the generator, which can then be used as a motor to rotate the crank shaft. As a matter of fact, however, the function of the batteries is to furnish current for the five incandescent lamps in the interior of the coach and for the outside lights. The battery is not used for driving the motors nor for equalizing the generator load in any way. In addition to the lights, the car has an electric attachment of a disc character, which shows a red sign automatically by day and a red light at night. This is set just above the rear platform and cuts in and out as the car starts and stops. The speed of the stage is 15 miles an hour on the level and 8 miles an hour on 8 per cent grades. It weighs complete about 7 tons. The wheels are equipped with solid rubber tires.

The vehicle provides seating capacity for from 28 to 30 passengers, and the body is of the street car type, conforming to the latest approved practice in being semi-convertible, so that in summer time the windows can be lifted entirely out of sight and stored in the roof of the car. The interior is finished in oak and bird's eye maple, and furnished with cane-covered seats for two persons each extending cross-wise, with an aisle down the center. The vehicle has a regular street-car step and platform, and a gate, which can be closed when all the seating space is occupied, so as to prevent the occupancy of standing room.

No data are yet obtainable as to the results with this vehicle, which, being the first of its kind, is likely to be materially improved as changes are suggested from practice. It is understood that the succeeding vehicles will be somewhat lighter, this being unnecessarily strong and substantial.

CURRENT NEWS AND NOTES.

KANSAS CITY CONDUITS.—A considerable development of its conduit system is being made by the Bell Telephone Company, of Kansas City, and more than three miles of conduit have been laid since last July.

LONG-DISTANCE WIRELESS AT SEA.—The steamer *Caronia*, of the Cunard Line, was in communication with the Marconi Siasconset station at 6.40 p.m. October 23, when she was 217 miles east of that station on her way to New York from Liverpool. From that point to her dock is almost a 24-hour run.

NEW YORK ELECTRIC TRACTION.—Work on the New York, Westchester & Boston Railway's four-track electric road to the Connecticut line is being rapidly pushed in four localities between 177th Street in the Bronx and the outskirts of Mount Vernon, and the contractor, Mr. J. P. McDonald, who has 20 months in which to build the nearly five miles of track, believes that he can complete the grading within one-half of the time set. Altogether the trackage of the road is 117 miles, including the branches.

"NO CONFISCATION."—Alarmed at the sinister aspect of his own campaign, Mr. W. Hearst, the Municipal Ownership candidate in New York City for Mayor, said last week: "There is no plan of confiscation in our programme. Our plan is to retain for your benefit and profit all of the franchises of the future—to make sure that they shall not be given away as in the past." This is different. This is "hedging." He added with truth: "I do not think there is anything unsound about that policy." Whoever said there was?

NEW YORK ELECTRICAL SOCIETY LECTURES.—Among the lectures scheduled by the New York Electrical Society for the season 1905-06 are the following: "Wireless Telegraphy," by William Marconi; "Electrification of the Long Island Railroad," by O. S. Lyford, Jr.; "Newspapers and the Telegraphic Art," by Melville E. Stone; "The Turbine," by C. G. Curtis; "The Place of the Electric Vehicle in Automobilism," by Robert McAllister Lloyd; "Single-Phase Railway Work," by C. F. Scott, and "The Block Signal System on the Subway," by J. M. Waldron.

TELEPHONY IN NEW YORK.—The pace of telephonic growth in New York is tremendous, another proof that good service brings its reward. Early in March, 1906, the New York Telephone Company will establish a new exchange district to be known as "Rector." It will take in the southern part of the exchange district now designated "Cortlandt." To make this change the company will increase its switchboard capacity in the Dey Street building by accommodation for about 10,000 telephones. At present this building has a switchboard capacity of 10,000 and the new installation will double this. For the operating considerations there will be two exchanges each of 10,000, although they will both be in the same building. For several months an addition to the Dey Street building has been under construction, which will double its size. This new building is about completed, thus making the increase of switchboard capacity possible.

WHAT SUBWAYS MEAN.—Mr. J. B. McDonald, the digger of the New York Subway—Interborough Road—said last week: "I am quite sure that when the new underground roads approved by the Rapid Transit Commission are built and in operation the city will be able to tear down its fifty miles of elevated railway structures, restore fifty miles of its ruined streets and give back to its property owners hundreds of millions of dollars' worth of real estate values. The elevated railways were all very well for the time in which they were built. They have done much to develop the city and serve the convenience of the people. But they are a blot upon an otherwise beautiful metropolis. Their ugly structures obstruct and darken fifty miles of our finest streets. They are noisy and make life very uncomfortable for pedestrians. They shut out the light and otherwise help to destroy the value of a hundred miles of buildings, counting both sides of the streets. When the new subways are built and in operation the elevated railway system will have outlived its usefulness, as the old omnibuses outlived their usefulness when the modern street car lines came into existence."

THE LONG ISLAND RAILROAD is slowly but surely being electrified. That way lies its salvation. It now has electrically operated about 40 miles of double track from Flatbush Avenue to Belmont Park; Woodhaven Junction to Rockaway Park, and Jamaica to Springfield Junction. By the beginning of 1906 it is expected that the route from Springfield Junction by Valley Stream and Cedarhurst to Beach Channel will also be operated by electricity. This is all the electrification which it contemplated for the present, and will require an expenditure of about $5,500,000. With the completion of the tunnel under the East River at Thirty-third Street, the remainder of the local lines of the company will be electrified. The company will have 180 cars of steel, of which 138 will be equipped with motors. At present about 80 are in use. The cost of these new steel cars is over $11,000 each. Since the increase of rates on February 1 gross earnings have increased at the rate of $60,000 per year, which will be about sufficient for the payment of charges upon the bonds issued for this electrical alteration. But the benefits of electrification will go much further than that.

THE CHICAGO ELECTRICAL TRADES EXPOSITION.—Mention has already been made in these columns of the formation in Chicago of the Electrical Trades Exposition Company to hold an electrical show in that city the coming winter. The company has as officers and directors a number of prominent men in the electrical trade and central station work in Chicago, the president being Samuel Insull. A circular has just been sent out announcing the plans in detail and giving plans of the exhibit space at the Coliseum, where the show is to be held. It will begin at 7 p.m. Monday, January 15, and continue until 10.30 p.m. Saturday, January 27, 1906. It will be open daily, except Sunday, from 10 a.m. until 10.30 p.m. Rental charges for exhibit space will be $1 per square foot on the main floor, and 50 cents per square foot in the balconies and galleries. Probably the conventions of at least three electrical organizations will be held during the time of the show, and exhibits made at this show will serve all the purposes of exhibits made at these conventions. Much interest is being displayed. The general manager is Thomas R. Mercein, secretary of the Northwestern Electrical Association, whose office is now 464 Monadnock Building, Chicago.

THE BEST OF LIGHTS.—A cable dispatch from Paris of October 21 says: "A new illuminant called lusol is being tried by the Paris authorities with a view to its use in the streets. It is said to be cheaper than electricity, gas or petroleum. Lusol is a product of the gases of cokes of certain mines, is rich in carbon and is said to possess superior illuminating power."

PUBLIC POLICY.—Mr. W. H. Blood, Jr., president of the National Electric Light Association, paid a visit to New York last week on association business. Mr. Blood has appointed as Committee on Public Policy Mr. Arthur Williams chairman; Messrs. Samuel Scovil, of Cleveland, Ohio; Ernest H. Davis, of Williamsport, Pa., and Guy E. Tripp, of Dallas, Texas.

DON'T PAY DUNNES.—It is stated from Chicago that Mayor Dunne has advised those who travel on street car lines for which the franchises have expired to refuse to pay the regular five-cent fare, and trouble is in store for the police and courts. The Mayor's followers are planning to court trouble with conductors over fares in order to embarrass the street railway companies, and will attempt to decide for themselves whether they will pay one, two or three cents a trip. "Mayor Dunne is trying to incite what might be called anarchy in the streets of Chicago," said one of the Aldermen recently. "The same plan was tried in 1883, and it led to riots and disorder." It is obvious that the Dunne plan, if carried out, might well reduce the Mayor himself to poverty and starvation.

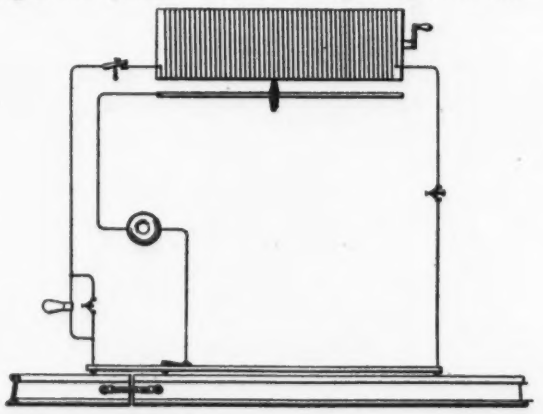
MARSHALL FIELD ON MUNICIPALISM.—Mr. Marshall Field, the great Chicago merchant, has just returned home from an European trip. In the course of an interview he said: "Among my observations abroad I took particular notice of conditions in Paris, where the municipality owns and operates the telephone system. Neither New York nor Chicago would put up for one day with conditions as they exist there." When asked for his opinion on municipal ownership Mr. Field said: "Municipal ownership is a fad, like the silver question was, and we will find that it will drop out of the public mind soon. I predict that within five years we in America shall not hear anything about it. I certainly don't agree with the proposition that municipal ownership would tend to do away with graft. On the other hand, I believe that opportunities for corruption would be greatly increased. Besides, a city under public officials never could be operated as a private corporation. The business of the municipality would fall into untried hands and what would seem everybody's business would prove to be nobody's business. I certainly know enough about the subject, after the campaign in Chicago, on which Mayor Dunne was elected, to know that municipal ownership would be a bad thing for us."

THE MILAN EXPOSITION.—United States Consul Dunning states that American manufacturers have considerably underestimated the relative importance of the Milan Exposition of 1906, which will continue from April to November in celebration of the opening of the Simplon Tunnel, and which will be a world's fair. Since the constantly increasing correspondence of the consulate at Milan seems to indicate a growing desire on the part of American exporters to sell their goods in Italy, Mr. Dunning believes the Milan Exposition affords an unusual opportunity for firms whose products naturally meet with the sharpest kind of European competition. If present tariff movements in more than one country in Europe may be taken to mean anything definite and significant toward American trade, it seems that our manufacturers will require a representation of their goods on the continent in future better than ever before. The exposition is to be on the grand scale, with which visitors to Chicago, Buffalo and St. Louis are familiar. Every branch of art, science, agriculture and the industries will be given ample space and adequate opportunities for exhibition. The entire fair will cover more than 1,000,000 square meters (10,764,200 square feet), of which one-quarter will be covered by buildings, which are already rapidly approaching completion. Japan, Germany, France, Mexico, Belgium, Switzerland, Austria, Great Britain and Italy will be officially represented at the fair, and nearly every other country in the world, including China, and the most active of the South American nations, will be largely represented as to their trades and evidences of their progress in every line of endeavor.

ROOSEVELT ON REGULATION.—In a speech last week at Atlanta, President Roosevelt said: "Undoubtedly there is need of regulation by the Government, in the interest of the public, of these great corporations which in modern life have shown themselves to be the most efficient business implements, and which are, therefore, the implements commonly employed by the owners of large fortunes. The corporation is the creature of the State. It should always be held accountable to some sovereign, and this accountability should be real and not sham. Therefore, in my judgment, all corporations doing an interstate business, and this means the great majority of the largest corporations, should be held accountable to the Federal Government, because their accountability should be co-extensive with their field of action. But most certainly we should not strive to prevent or limit corporate activity. We should strive to secure such effective supervision over it, such power of regulation over it, as to enable us to guarantee that its activity will be exercised only in ways beneficial to the public."

SCIENTIFIC STUNTS.—Prof. W. Hallock, the well-known physicist of Columbia University, has an interesting article in the New York *Times* on measuring the infinitesimal. He defends such beautiful work and says: "In science as in every-day life it is interesting sometimes to do things just for the sake of doing them, just to show that they can be done. There may be serious question whether there is much practical value in the demonstration that an automobile can be run at a speed of over 60 miles an hour for a hundred or more miles, and yet many wish to do it, or see it done. Similarly the skilled mechanic who succeeded in drilling a hole lengthwise through a cambric needle demonstrated his skill and patience, but where was the practical value of what he produced? Such performances come under the head of what the boy calls "doing stunts." The scientist is human and needs his recreation, and sometimes "does stunts." The construction of a "pseudoscope," which reverses the perspective in objects, is amusing, but it proves nothing, and can scarcely be said to advance science. Of a decidedly more serious character are such endeavors as may lead to some fact which is of interest in itself; for example, what is the smallest object that can be seen with a microscope, what is the faintest light that can be seen, what amount of energy must there be in a sound in order that we may hear it? These and other similar questions are of decided interest, although they may not really advance the science of acoustics, for example, more than the pseudoscope does the science of optics."

TESTING RAIL BONDS.—The accompanying illustration shows the connecting circuits involved in a method for testing rail-bonds as proposed by Mr. M. M. Wood in a patent issued October 17. The apparatus operates upon the principle of the Wheatstone bridge. The resistance of the bond is compared with that of a certain length of the rail. A resistance wire of German silver is wound upon a helically-grooved cylinder which is arranged to be revolved. As the



cylinder is turned, an intermediate contact wheel moves lengthwise and varies accordingly the values of the resistances included between this contact and the terminal points. A telephone receiver, which is connected in the circuit to the intermediate contact, as shown in the illustration, serves to determine when the portions of the resistance wire on either side of the point of the contact bar bear the same relation to each other in resistance as the corresponding portions of the rails between the several contacts.

FRANKLIN INSTITUTE LECTURES.—Mr. Oscar T. Crosby, who is one of the Institute lecturers this month, on Monday, October 23, described his interesting travels in Thibet and Turkestan, in which he and his associates had a very narrow escape from death by exposure and starvation.

ELECTRIC SWITCHES AND SIGNALS.—Plans have been approved and contracts let for the installation of an electrically-operated switching plant on the New York, New Haven & Hartford Railroad at Mystic, Conn., similar in construction to that which is nearing completion at Derby Junction.

BOSTON BOAT AND TROLLEY.—The New Line has installed a trolley system in connection with its Sound steamboat service between Fall River and Boston. The run of fifty-three miles by trolley occupies three hours and twenty-seven minutes. The route is by way of Taunton, Brockton, Blue Hills, and the Boston Park system to Post Office Square, Boston. Limited excursion tickets are sold from this city to Boston. The trolley route is very pretty.

TELEPHONE CONSTRUCTION SUPERINTENDENTS.—A meeting of division and construction superintendents of the Cumberland Telephone Company was recently held at Nashville, Tenn. Among the questions discussed were, the best method of cable work, the best plant for the proper handling of toll line maintenance and installation, and how best to provide the local managers and operators to insure the best service for the public. There was a large attendance, and a lunch was tendered the delegates by the Cumberland Company at the Duncan Hotel.

GROWING PLANTS BY ELECTRIC LIGHT.—According to a Washington dispatch the Department of Agriculture has begun extensive experiments into the growing of plants by electric light. Most plants, it is stated, grow only during the day and rest at night, and the experiments, aside from their scientific value, will be made with the object of forcing the growth of vegetables, etc., so that they will work twenty-four hours a day instead of twelve or so under normal conditions. The economic side of the question will also get careful attention to ascertain if the outlay of electricity can be returned at a profit.

WIRELESS IN THE PHILIPPINES.—It is stated that General Greely, chief signal officer of the United States Army, has decided to install a wireless telegraph system between Zamboango and Jolo, Philippine Islands. General Greely, it is reported, was not favorably inclined to a wireless system in the Philippines at first on account of the necessity for experts, but the cable between Zamboango and Jolo has been interrupted so often that wireless seemed to be necessary. For nearly forty miles from Zamboango the bottom of the ocean consists of coral reefs. The strong tides that flow between the islands wear the cables against the coral, and they are frequently cut and rendered useless. It is expected that the wireless system will be in operation in about three months.

WIRELESS NEWS OF SHIPWRECK.—News of a shipwreck at sea came by wireless telegraph on Oct. 15 from the Cunard Line steamer *Etruria*, which sailed from New York for Liverpool on Oct. 14. The *Etruria* found the Swedish bark *Orion* in distress, 500 miles east of Sandy Hook. A crew from the *Etruria* rescued the *Orion's* men and the latter vessel was abandoned. Captain Olson of the *Orion* said he would like his owners in Gothenburg to know that the bark had been abandoned and that all hands had been saved. Captain Potter of the *Etruria* said he would immediately send word ashore. His Marconi operator called up the station at Cape Race and in a few minutes the first wireless report of a rescue one-sixth of the way across the Atlantic had been sent to land. Incidentally it may be stated that the abandoned bark was found later by the steamship *Exeter City* and towed to St. John, N. B., as a prize.

AN ARGUMENT FOR ELECTRIC HEATING.—The central station manager in a suburban town near Chicago has recently been figuring with the owner of a large summer hotel for the installation of electric curling iron heaters throughout. The argument which he used with the proprietor of the hotel will no doubt be of interest to other central station men in getting business, and may assist them in closing similar contracts elsewhere. This manager found that the reduction in insurance premium for the first year on this hotel by virtue of the substitution of electric curling iron heaters for dangerous alcohol lamps would pay for the entire cost of the heaters necessary for the hotel. In most cases the plan called for curling iron heaters in bath rooms. For rooms without bath, portable curling iron heaters could be obtained upon application by the guests. In this way the total number of heaters needed for rooms without bath would not be large.

SYNCHRONIZING IN PEORIA.—Visitors to the plant of the Peoria Gas & Electric Company, during the recent convention of the Illinois State Electric Association, were interested in noting the arrangements for synchronizing three-phase generators. The switchboard is located at one end of this plant and some of the most important generators are a long distance from the switchboard at the other end of the engine room. The intervening machinery prevents the men at the engine from seeing the switchboard attendant. This attendant has a switch controlling one incandescent lamp high in the center of the engine room, which is in sight of every part of the room. With this he can signal to the engineer whether the generator to be synchronized is above or below speed. In the ordinary station routine, however, much use is made of an alternating current arc lamp which hangs near the generator. When the frequency of the generator equals that of the bus bars from which the arc lamp is supplied, the revolving fields appear stationary.

THE GREATEST OF STEAMERS.—The new steamer *Amerika* of the Hamburg-American Line arrived at New York on her maiden voyage on October 20. This ship is the largest in the world as to tonnage, and fitted with every modern convenience for the comfort of her passengers. Her electrical equipment is varied and extensive. There is an electric elevator on the starboard side of the ship, which carries the passengers to and from four decks. The decks are named "Kaiser," "Washington," "Roosevelt" and "Cleveland." The *Amerika* also has a complete telephone system aboard, including a central station, by means of which a passenger in any one stateroom may converse with another passenger in any other stateroom. Her electric light plant is very complete, and among the other electrical features are a Marconi wireless telegraph equipment, submarine bells, electrically-operated bulkhead doors and electric baths. Other features of the great ship include a restaurant, where meals are served *a la carte;* a florist's shop, a gymnasium, etc. The *Amerika* can carry 3,057 passengers. She has a cargo-carrying capacity of 16,000 tons, is 687 ft. long, 74 ft. 6 in. wide and 53 ft. deep and displaces 42,000 tons.

SELF-STARTING SINGLE-PHASE INDUCTION MOTOR.—In the usual form of repulsion motor, the current produced by the alternating flux in the coil short-circuited by the brush under starting conditions is in a direction to give a negative torque to the rotor. If the main short-circuiting connection between the brushes of opposite polarity be opened, the rotor will revolve in the negative direction when each brush covers a sufficient number of segments. When it is desired to place the motor in operation by means of this torque it is advantageous to introduce current into the armature from the source of supply by way of the brushes on the commutator. If the brushes are connected in series with the primary circuit of the motor, the rotor will operate under the torque noted above combined with that due to the series-motor properties of the machine, and it is possible so to adjust the ratio of stator to rotor turns that the series current in the armature will just equal the current in the coils being short-circuited, under which conditions the sparking at the commutator is reduced to a minimum. In a patent issued October 17, to Mr. Robert Lundell, there is described a method by which the motor may be started up from rest as described above, and may be converted into a simple single-phase induction motor when full speed is attained. Each brush is composed of two parts, each of which is designed to straddle or short-circuit a number of commutator bars and armature coils corresponding to somewhat more than 90 electrical degrees. At the time of starting, about one-half of the commutator-bars and armature coils are short-circuited by the brushes. At the time of synchronous running, all of the armature coils are electrically short-circuited, on account of the fact that each double brush is mechanically separated so as to cover somewhat more than 180 electrical degrees on the commutator.

CHICAGO STREET RAILWAYS.—At Chicago, on October 17, Mayor Dunne succeeded in putting the City Council on record on the question of municipal ownership. The Aldermen voted—37 to 27—against it. The Mayor sent to the Council an order directing the local transportation committee to cease negotiations with the street railway companies for a franchise, and the vote was taken to indicate that a majority of the Council favor the passage of a franchise ordinance. The vote showed only one over a majority of the Council, however, and not enough to pass the ordinance over a veto of the Mayor. The Council pledged itself not to pass any franchise ordinance which had not first been submitted to the people and approved by them.

GERMAN ELECTRICAL STRIKE.—A special dispatch from Berlin of October 14, says: "The strike of the electrical workers is ended. At a conference to-day the delegates of the workingmen voted to accept the associated companies original offer of 5 per cent increase in wages. The result is a complete victory for the employers. The decision of the hardware manufacturers to lock out their 20,000 workmen unless the electrical strikers returned to work was the prevailing reason for the strikers accepting the terms offered them. The strike was never popular with the laboring classes generally, who regarded it as more a trial of strength between the employers and the employed than as a measure of necessity, as the public considered the coal strike in Westphalia to be."

MORE TROLLEYS IN JERSEY.—Maps filed in the Hudson County Clerk's office in Jersey City by the new Hudson Street Railway Company show that the company intends to build about 50 miles of trolley connections as a feeder to the tunnel that the William G. McAdoo company is building under the Hudson River to the foot of Morton Street. The tunnel was started with the expectation that the Public Service Corporation, which controls all the trolley lines in North Jersey, would patronize it, but recently the Public Service announced its intention of building a tunnel of its own. The maps filed indicate a purpose on the part of the new company to gridiron the county with its tracks and invade all the territory now served by the Public Service. Lines are mapped out to extend south from Jersey City to Bayonne and north into Hoboken and the cluster of populous towns beyond.

SOCIALISTIC PLAIN SPEECH.—The Socialist Labor party in New York is dead against municipal ownership. Its candidate for Mayor says it is a wisp of hay before the noses of donkeys. At a recent meeting James Connolly, who was introduced as a close student of the municipal ownership question, said: "Hearst has been telling us through his newspapers that great good has been done in Europe for the workingmen by the adoption of municipal ownership. Then why, I ask him, is it that 100,000 working men are coming here from Europe every year? On the same page of his paper I read an article crying out against the influence of pauper labor into this country. They have talked a lot of Glasgow. I believe that Hearst even brought over here one of the city officials to tell Chicago about municipal ownership. I have been in Glasgow and if that's your conception of Paradise, head me for the other place. In that city there are 30,000 houses of only one room each. There have been more strikes on the municipally-owned railroads in Glasgow through the efforts of workers to establish the rights to form trade unions than in any other city in Europe. Municipalism is no cure for the ills that we seek to remedy. It is worse than any of the other isms, and it pleases me to see that none of you have been led astray by its fallacious teachings."

STREET CAR CONDUCT.—The John D. Rockefeller Bible class devoted its time last Sunday to street car ethics. The Rev. W. S. Richardson, the leader of the class in the absence of Mr. Rockefeller, said: "I often wonder whether New York people are more greedy than others. When I see the way persons rush for the cars, shoving every one aside in order to get a seat, I sometimes think they are. I know a very nice young man, one who was always the very acme of politeness. Not long ago I met him while boarding a street car, and was surprised to see how he rushed for a seat, letting women and children stand. I made remarks about his manners, and he said to me: 'I am important to my family. Since I got married I don't give up my seat to anybody in the cars.'" One man in the class said he was a stranger in the city, and was perhaps better able to judge of New York's manners than one who had lived there all his life. He said he found New York men more polite and courteous than he had expected. Dr. Conklin, a member of the class, said he never suspected how kind New York persons are until a few years ago, when he was obliged to use a cane owing to an accident to his leg. Whenever he entered a car, he said, not only the passengers, but even the conductor, showed him the greatest kindness and saw to it that he got a seat.

Electrical Engineers of the Times.—XXXIII.

MR. JAMES E. DAVIDSON.

Mr. James Edward Davidson was born at Flint, Mich., November 10, 1879. He is the son of Mr. W. F. Davidson, of Port Huron, a pioneer in central station installation and operation in the State of Michigan, in which state he represented the Thomson-Houston Company for some years as agent. After passing through the public and high schools of Port Huron, Mr. Davidson took a course at the Detroit Business University. As a boy his vacations were spent in the power house at Port Huron, and after leaving school he went at once to work in that plant, of which he became superintendent in 1899.

The Port Huron Light and Power Company's plant, which was described in these columns in the issue dated April 9, 1904 (this article was written by J. E. Davidson), has a capacity of 3,000 kw, and besides furnishing current for street, commercial and residence

JAMES E. DAVIDSON.

lighting, supplies power for street and suburban railways as well as for a number of large manufacturing plants. During Mr. Davidson's superintendency a 1,500-kw Curtis turbo-generator was installed, this being the first steam turbine of this make put into commercial operation. In 1902 he was appointed city electrical inspector of Port Huron, a position which he held until his removal to the East.

In the spring of 1905 a syndicate of Port Huron and New York capitalists purchased the plant of the Consolidated Lighting Company of Montpelier Vt., and invited Mr. Davidson to take the management of the business. Upon his acceptance he was made a member of the board of directors, secretary of the company and general manager of the plant. The plant of this company includes a water power station at Bolton Falls and a steam plant at Montpelier. The former, which has a capacity of 2,500 hp, is operated by water power, and the latter is a steam plant of 750 kw capacity. At present a 750-kw steam turbine plant is being installed in the steam station, and the water power plant will soon be enlarged by the addition of a 2,000-hp water wheel and a 1,300-kw generator. These stations supply lighting and power to Montpelier, Barre, Waterbury and surrounding towns, and power is also supplied to the Montpelier & Barre Traction Company. In Barre and vicinity are some of the largest quarries and finishing sheds in the United States, and the additions to be made to the Consolidated plant will be largely to furnish reliable and economical power for quarrying and manufacturing granite.

Mr. Davidson is an associate member of the American Institute of Electrical Engineers, and was secretary and treasurer of the Michigan Electric Association up to the time he left Port Huron.

Development of the Necaxa, Mexico, Water Power.

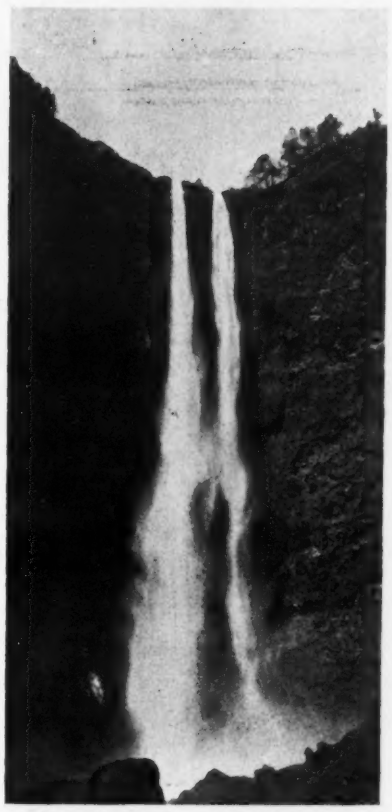


FIG. 1.—THE SECOND NECAXA FALLS.

ONE of the most striking and interesting developments of water power that has recently been carried out in the Republic of Mexico is that connected with the utilization of the Necaxa Falls by the Mexican Light & Power Company under the initiative of Dr. F. S. Pearson. This great enterprise has as its field of operation the great central Mexican plateau, where it is developing and conserving the energy of the Tenango and Necaxa Rivers. At a point 100 miles northeast of the City of Mexico these rivers debouch from the mountain chain at a height of about three-quarters of a mile above the sea, their joint flow being discharged finally into the Gulf of Mexico. An idea of the region and power is given in Figs. 1, 2, 3 and 4. These two rivers drain jointly an area of about 227 square miles, and on account of the geological nature of the plateau encountered a remarkable succession of waterfalls resulting in a total drop of more than 3,000 feet in a distance of three miles. The plan adopted for the utilization of the water power thus available is indicated roughly in Figs. 5 and 8. The Tenango River has been consolidated with the Necaxa by diversion and their joint flow has been stored in a

FIG. 2.—TENANGO FALLS, MEXICO.

reservoir lake at Necaxa, as indicated in Fig. 8. From this reservoir by a tunnel and pipe line, as indicated, the water is carried to the first power plant with a total drop of 1,470 feet in a mile. It is thus utilized at the first power house shown in Fig. 8, but will ultimately be utilized again at the end of another drop

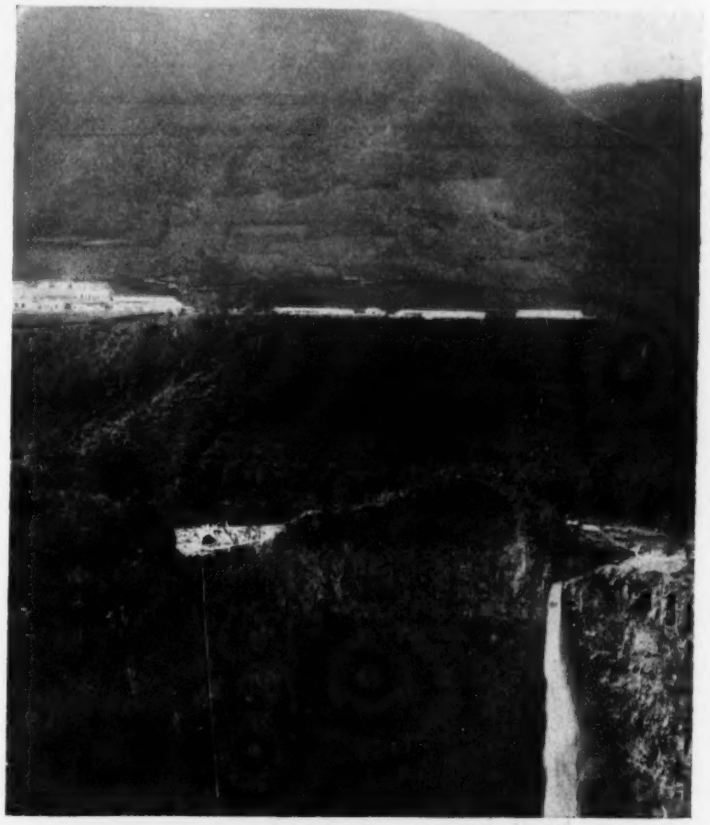


FIG. 3.—GENERAL VIEW OF NECAXA FALLS REGION AND CONSTRUCTION CAMP.

of 1,100 feet. The two plants are to have a final capacity of not less than 80,000 hp. As indicated in Fig. 6, the power is to be

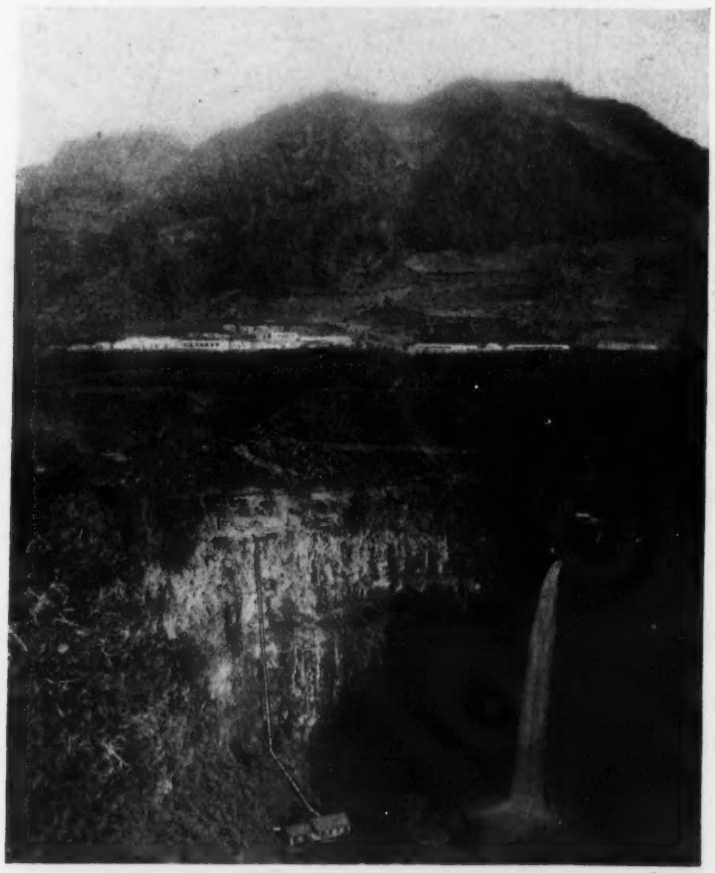


FIG. 4.—TEMPORARY PLANT AND CABLEWAY AT FIRST NECAXA FALLS.

carried by a transmission line from the first power house to the City of Mexico, and also far beyond that point to the mining district of El Oro, giving a total line transmission of 171 miles.

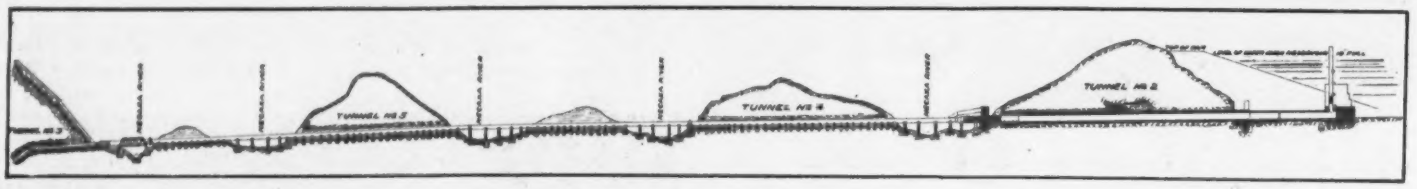


FIG. 5.—PROFILE OF PIPE LINE.

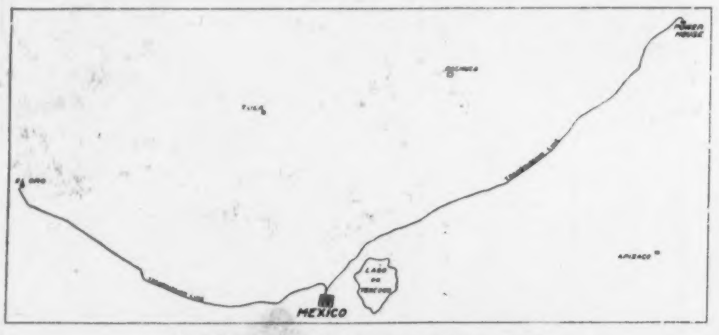


FIG. 6.—ROUTE OF TRANSMISSION LINE.

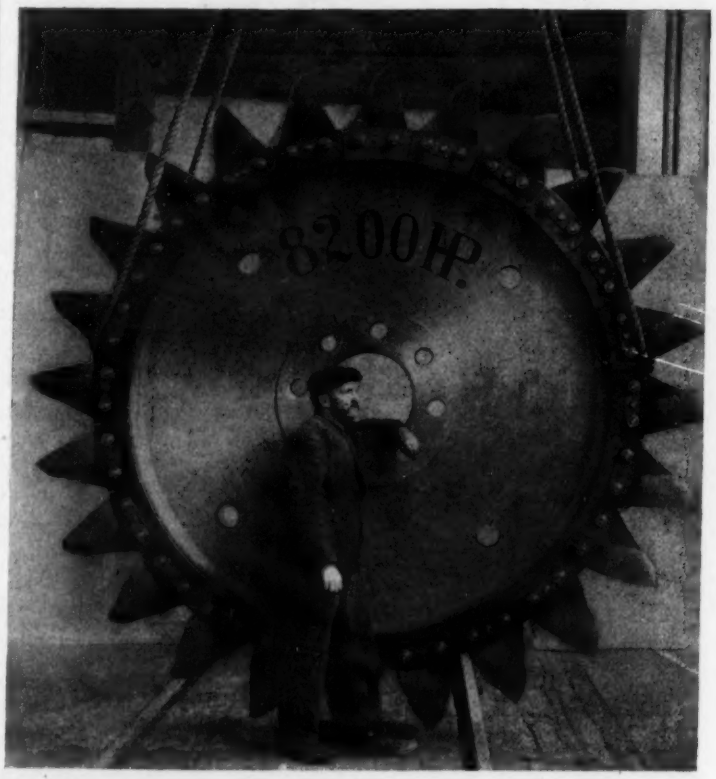


FIG. 7.—IMPULSE WHEEL EMPLOYED AT NECAXA.

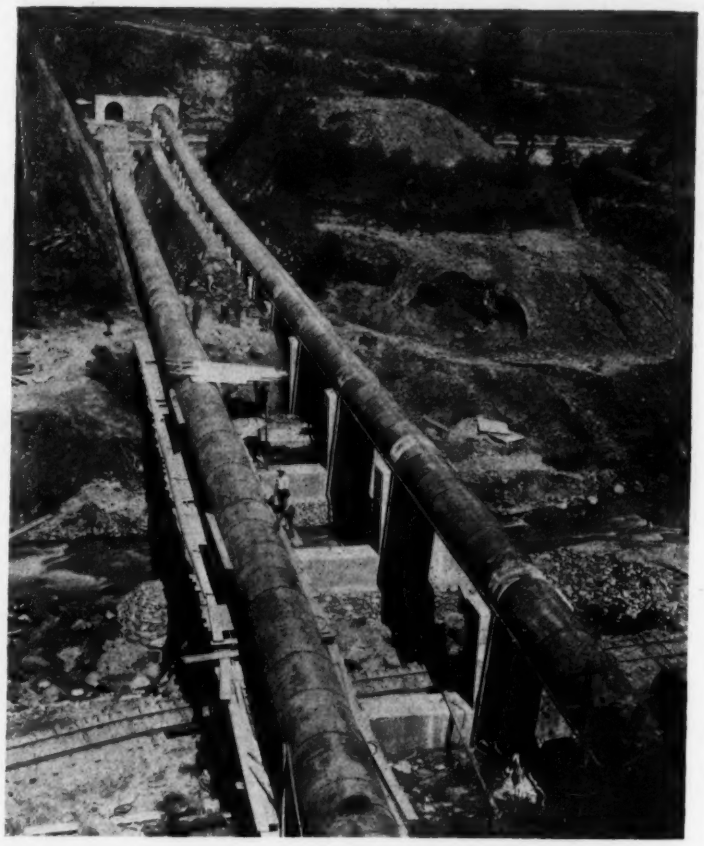


FIG. 9.—VIEW OF THE PIPE LINE FROM TUNNEL NO. 5.

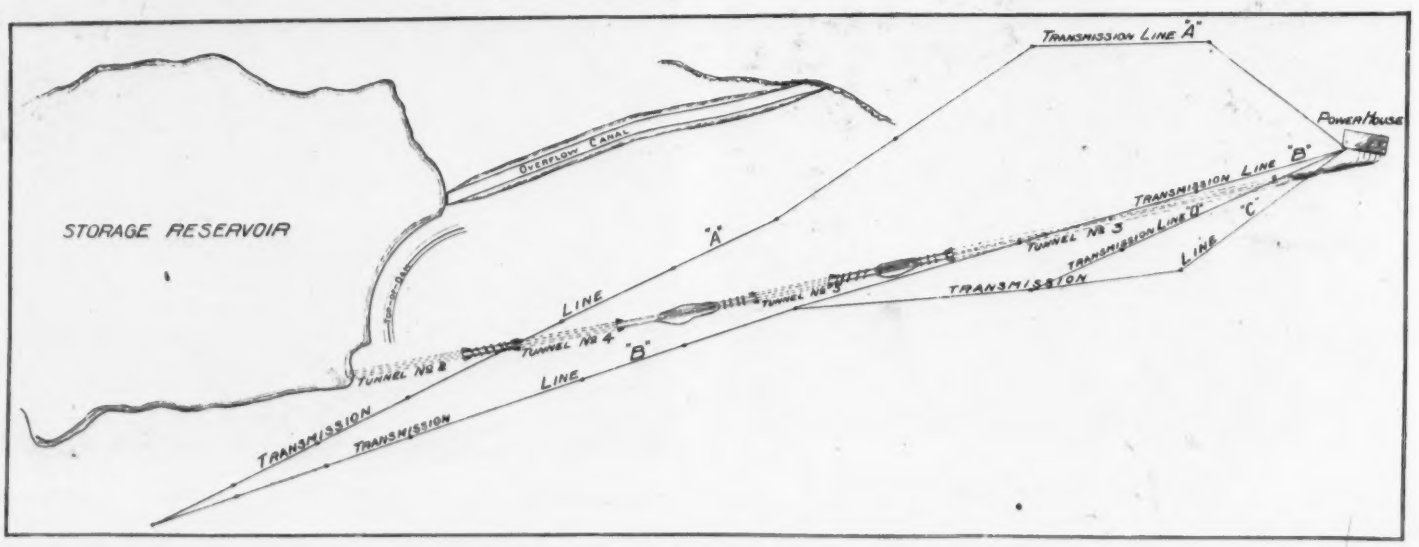


FIG. 8.—MAP OF TRANSMISSION LINES AND PIPE LINE.

FIG. 10.—GENERAL VIEW OF COUNTRY AND TRANSMISSION LINE.

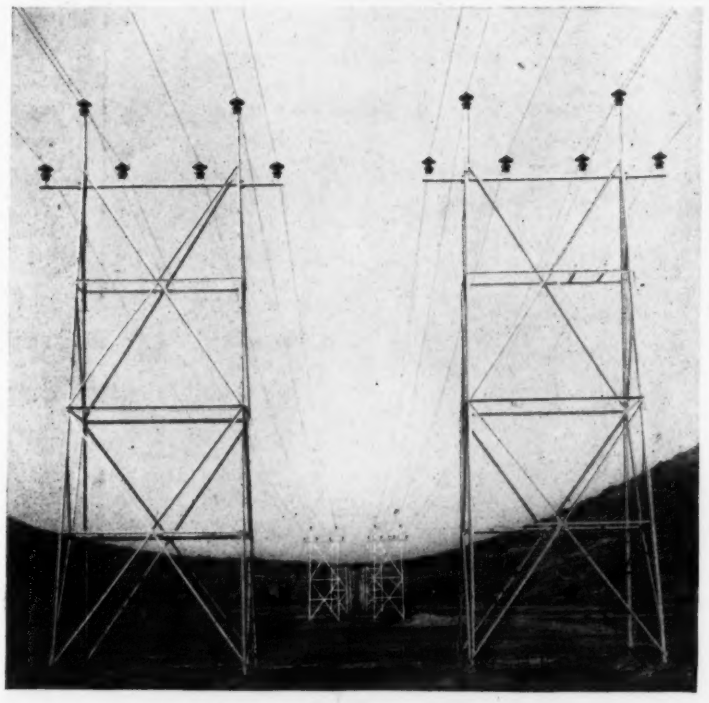


FIG. 11.—VIEW OF TWIN LINE, NEAR MEXICO CITY.

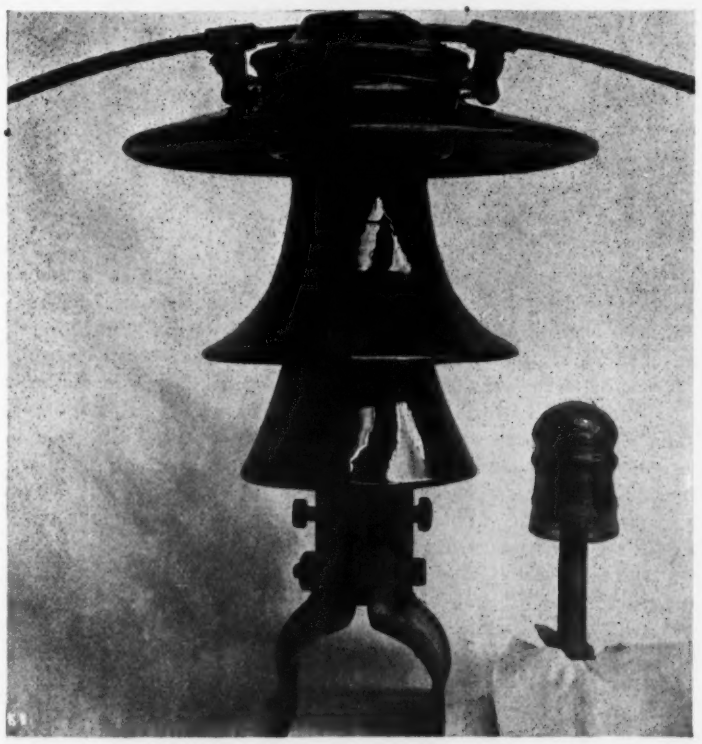


FIG. 12.—COMPARATIVE VIEW OF MAIN LINE AND TELEPHONE INSULATORS.

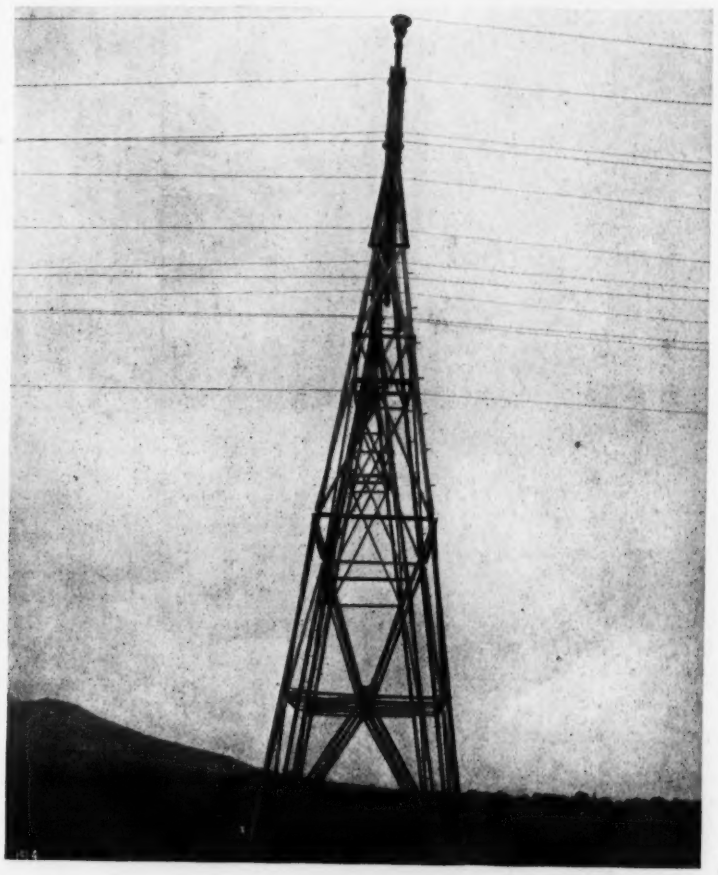


FIG. 13.—SIDE VIEW OF NECAXA TRANSPOSITION TOWER.

FIG. 14.—NEW SUB-STATION FOR NECAXA POWER, CITY OF MEXICO.

The engineering involved is of a most able and ingenious character, and the plant when completed to its full capacity will present many features of surpassing interest. The dam of the Necaxa Lake is of earth 177 feet high and 600 feet long, with a base width of 950 feet and a width of 54 feet at the top. No less than 2,000,000 cubic yards of material were required for the wall, obtained chiefly by blasting. A three-square-mile lake has thus been created from which the impounded water is carried off by means of two pipe lines, as shown in Fig. 9, running in a series of tunnels 1,500 ft. long. Beginning with two vertical intakes with gates at different levels, these pipes end in a receiver from which six seamless steel tubes are carried to the power house itself.

The horizontal penstocks are 8 feet in diameter and 3/8 inch thick, passing through the first tunnel, after leaving which they narrow down to 6 feet, and run down stream for 2,800 feet, of which distance the pipes are partly in tunnel, partly in open cut and partly on piers, crossing and recrossing the windings of the river. Then under a head of 180 feet, the penstocks empty into the receiver 22 ft. long and 7 ft. in diameter, out of which proceed the six 30-in. smaller pipes leading to the power house (Figs. 18 and 19). The two halves of the system can be separated from each other, and either part run without interference. All the pipes are connected to the receiver through gate valves. The pipes from the receiver descend a distance of 2,300 ft. to the power house, of which 1,900 ft. is in two parallel tunnels at an angle of 41° from the horizontal. In each tunnel there are three pipes supported on concrete, with anchorages and expansion joints.

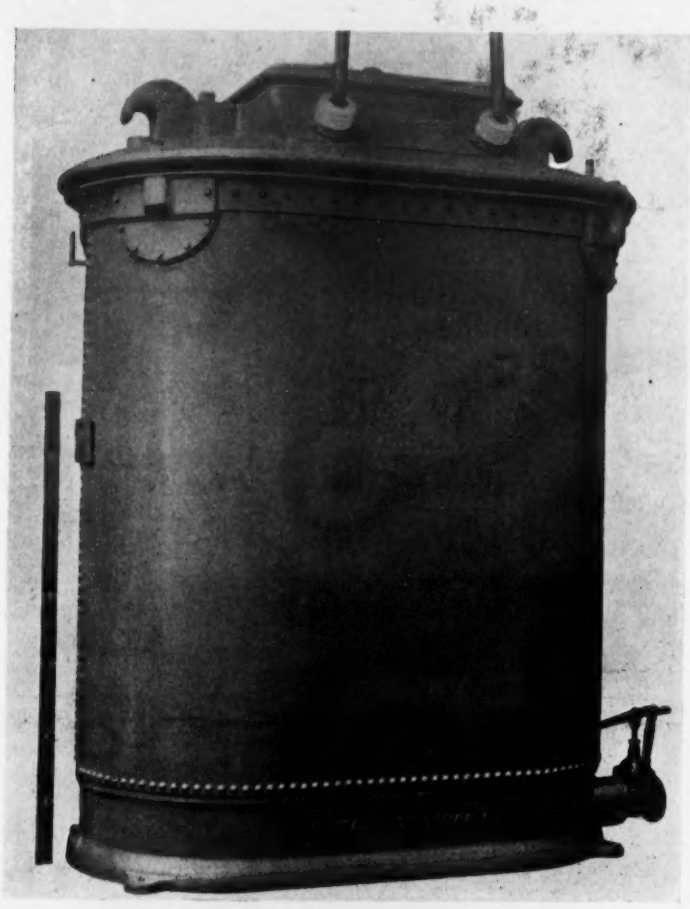


FIG. 15.—NECAXA STEP-UP OIL TRANSFORMER.

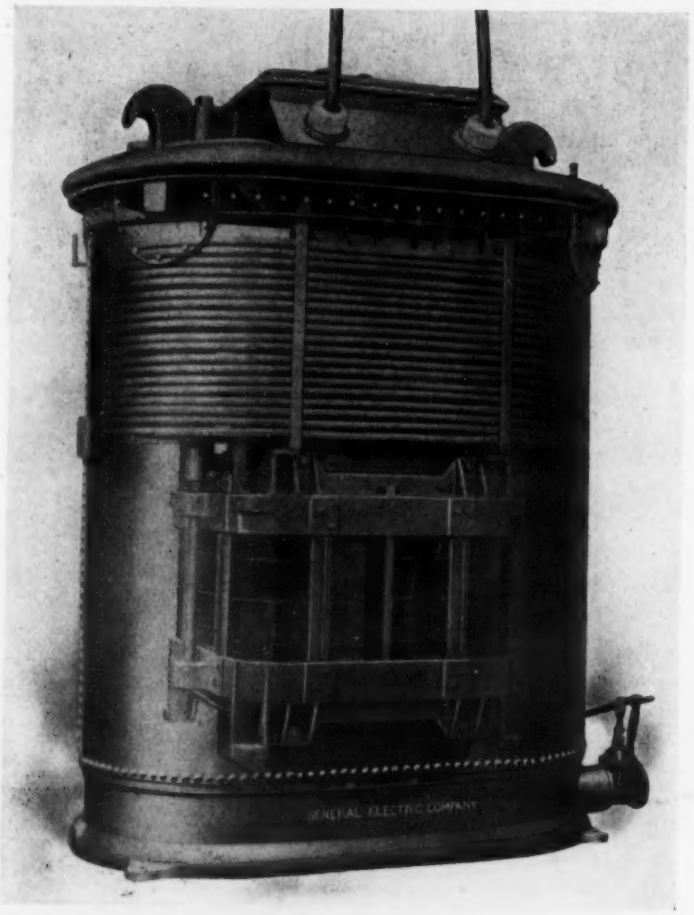


FIG. 16.—INTERIOR VIEW OF NECAXA TRANSFORMER.

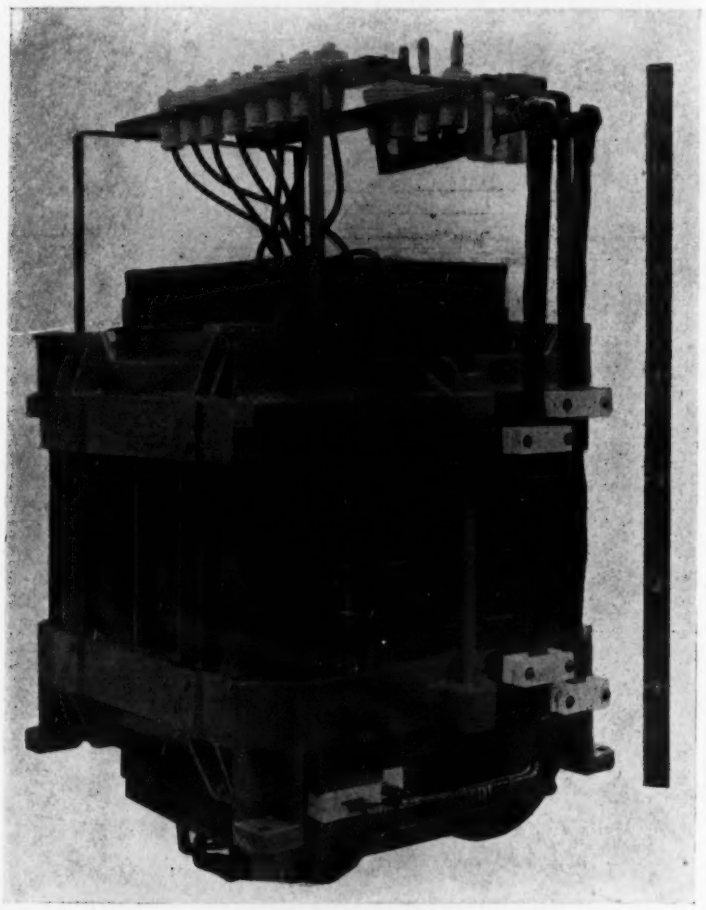
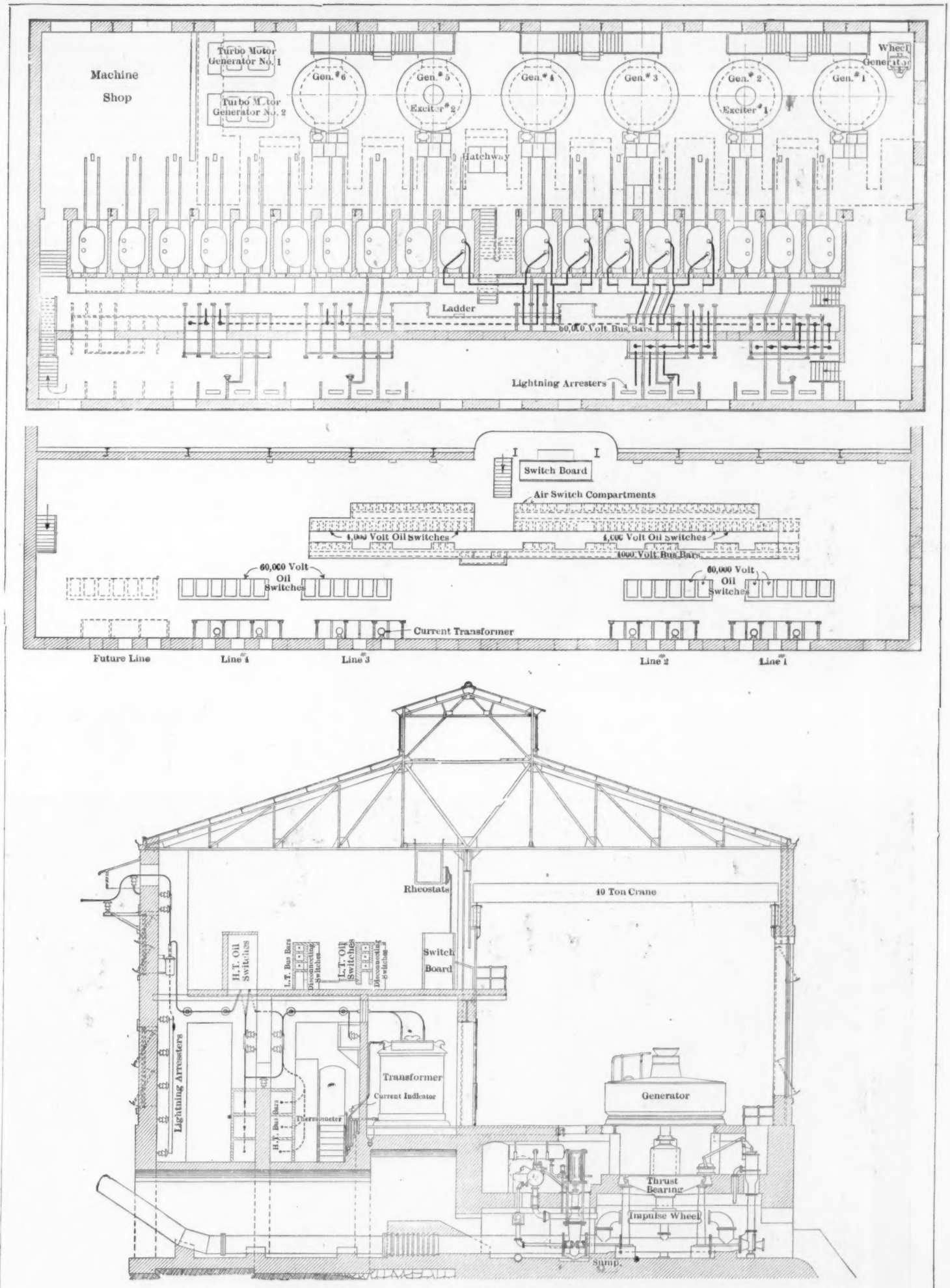


FIG. 17.—CORE OF NECAXA TRANSFORMER.

A vertical relief pipe 240 feet in height and 20 inches in diameter is connected to the upper end of each of the six pipes. It is interesting to note that these pipes are seamless steel tubes—made in Europe—with flanges, each piece being forged out complete from one piece of sheet steel. The outside diameter of the tubes is 30⅝ inches throughout, with a variation inside from 0.4 to 0.95 inch, the minimum diameter being 29 inches. Before the flanges were hammered out two cast-steel clamping rings were slipped on to each 30-foot section of tube.

The initial apparatus in the main power station No. 1 has been furnished by the General Electric and Siemens-Schuckert Companies, and comprises six 5,000-kw, 4,000-volt, 50-cycle, three-phase, vertical shaft generators of Siemens-Halske construction. Each generator is driven by an impulse water wheel carrying 24 buckets at its periphery. The wheels (Fig. 7) are those of Escher, Wyss & Co., of Zurich, Switzerland. They are 100 inches pitch diameter,



FIGS. 18 AND 19.—GENERAL PLAN AND CROSS-SECTION OF POWER HOUSE NO. 1, NECAXA.

running at 300 r.p.m. and each has two 4½-in. square regulating nozzles fixed on opposite sides of the wheel but operating together.

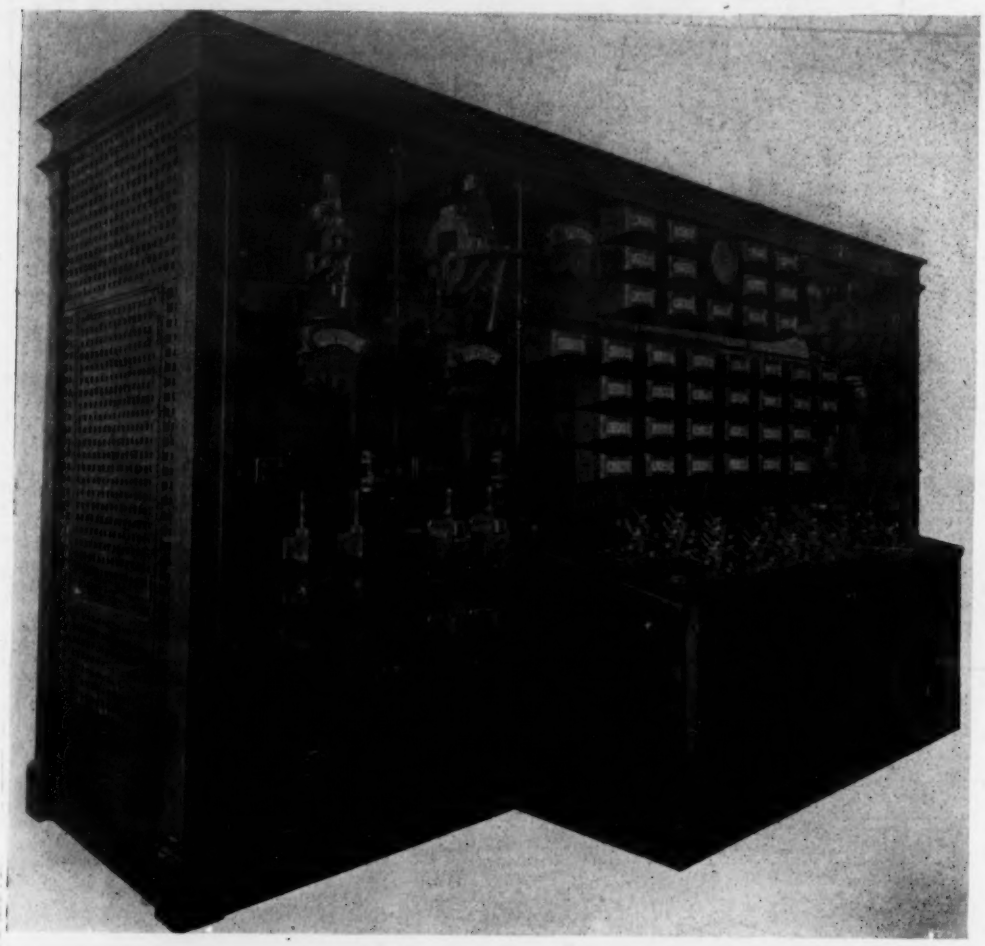


FIG. 20.—THE BENCH-TYPE SWITCHBOARD, NECAXA POWER PLANT.

The current furnished by the generators is delivered to 18 General Electric 2,000-kw transformers stepping up to 60,000 volts, the outfit being divided into six banks of 6,000 kw each. The transformers (Figs. 15, 16 and 17) are oil-immersed and water-cooled. The equipment includes also a fine switchboard of General Electric make, two 250-kw, 125-volt, shunt-wound exciters, direct-connected to three-phase, 4,000-volt induction motors, and three 50-kw, 125-volt, shunt-wound, water wheel-driven exciters. The switchboard is of the bench type, as shown in Fig. 20.

The power house No. 1 in the Necaxa canyon itself is a massive building of steel and masonry, 235 ft. long, 88 ft. wide and 60 ft. high. All the material for its construction, as well as the apparatus for the plant had to be transported with great difficulty and finally to be swung down over cliffs and by means of inclined cableways some 1,500 ft. before it could be assembled at the point of utilization. The power house is equipped with a 40-ton electric crane for handling all apparatus, and special attention has been paid to the machine shop equipment, as it will be readily understood that a plant in such a position is not favorably situated for getting any of its repairs done outside, but must be furnished with the means for grappling with even the largest job of that nature.

The transmission system (Figs. 10, 11 and 13) includes four three-phase, 10,000-kw, 60,000-volt transmission lines, as well as a local power and lighting service. In order to insure stability of construction and permanence, as well as continuity of supply, steel towers have been used for the transmission line, there being two of these carrying the four separate circuits direct into the City of Mexico, and two separate circuits from the City of Mexico onward to El Oro. These steel towers are 40 ft. high on 500-ft. spans or higher when the spans are strung to a length of 1,200 ft. There

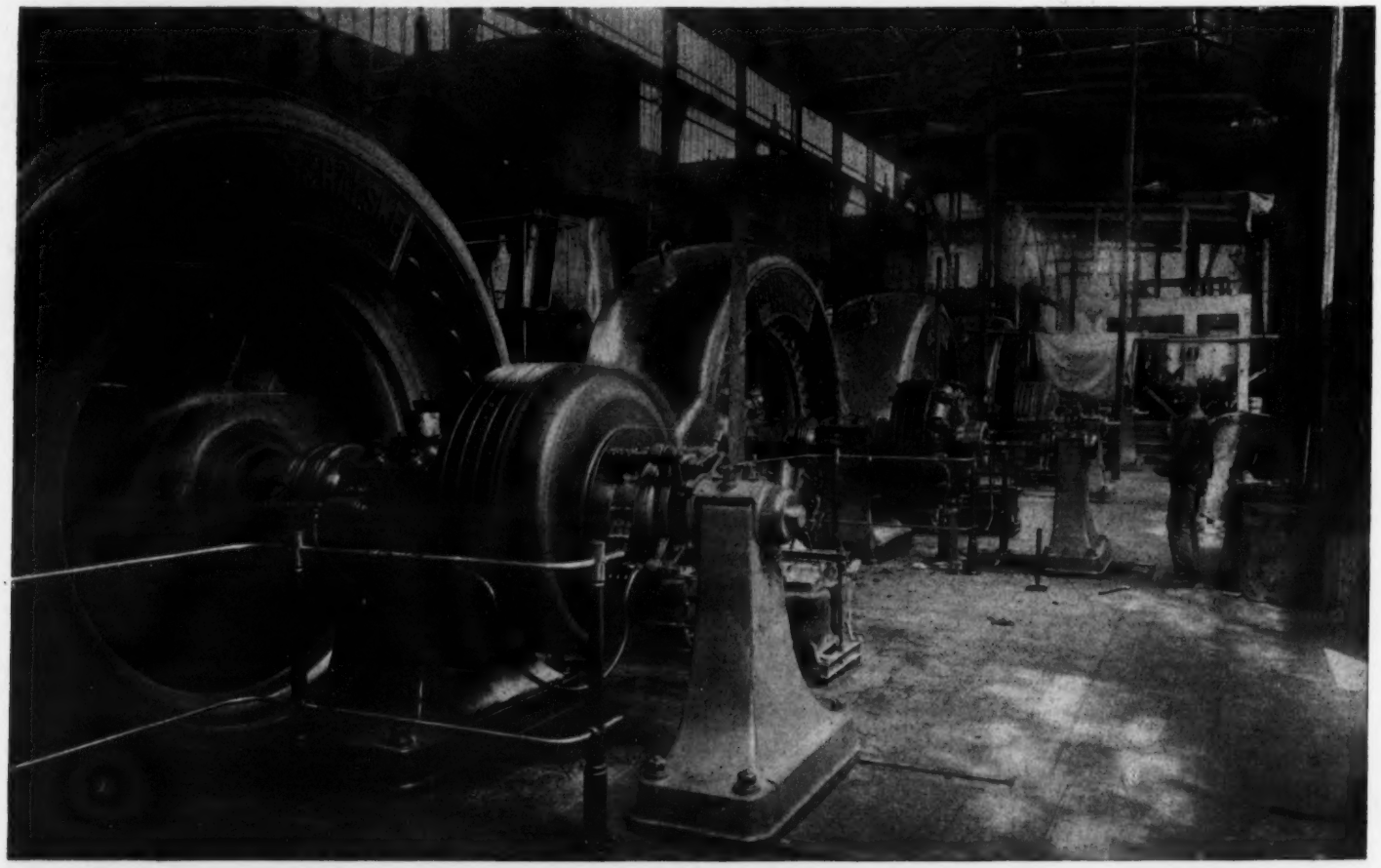


FIG. 21.—THE OLD STEAM PLANT ADJOINING NECAXA SUB-STATION, MEXICO CITY.

are 534 miles of circuit and 1,602 miles of aerial cable. At full load the loss between Necaxa and the City of Mexico is 8 per cent, and from the City of Mexico to El Oro 5 per cent more.

The transmission towers, set 5 ft. in the ground, are built of angle steel, heavily galvanized, with 3 x 3 x ¼-in. posts for the corners spaced 14 ft. apart across the line and 12 ft. along it. The cables are carried 40 and 46 ft. above the ground and are six-strand copper, ½ in. diameter, shipped in lengths of 3,000 ft., and with joints made with 18-in. twisted copper sleeves. They are attached to the insulators by clamps instead of tie wires. The insulators (Fig. 12), made by R. Thomas & Sons, of East Liverpool, Ohio, have been assembled and cemented on the spot, and although receiving a test before shipping, while wet, of 60,000 volts, are again tested when assembled with 120,000 volts potential. The insulator pins are set into the insulators with Portland cement and are 15 in. long, of 2-in. steel pipe, set in drop-forged sockets, mounted on a 4-in. pipe cross arm for the lower cables and 3-in. for the upper. The towers carry also No. 10 copper telephone circuits, 10 ft. below the cables.

The sub-station work at the City of Mexico is connected with a remodeling of the old steam Siemens-Halske station (Fig. 21), to which four Curtis-General Electric turbo-generator units of 500 kw each are being added. The equipment of the sub-station (Fig. 14) includes 12 1,800-kw oil transformers in separate fire-proof compartments with switching and wiring, also in separate cells. The transmission can be at 20,000, 40,000 or 60,000 volts, and the step-down transformers are arranged to furnish current at 1,500, 3,000 or 6,000 volts. The sub-station at El Oro has nine step-down transformers of 1,800 kw each, similar to those in the City of Mexico. In the latter place ordinary city distribution is dealt with, but at El Oro the current is to be used chiefly for mining operations on some of the largest veins and ore bodies of gold in the world.

The work on this great enterprise is now virtually complete, so far as power plant No. 1 is concerned, and as announced in these pages last week, Mr. R. F. Hayward, of Utah, has been made general manager of the company, a position for which his previous engineering practice and experience have richly qualified him.

Dynamo Heating Time Constants.

By A. Press.

When a dynamo is placed in operation after having been allowed to become thoroughly cold, the internal losses of the machine cause its temperature gradually to approach a certain maximum value above that of the surrounding medium. With a certain constant value of losses being produced within the machine, and a certain unchanging condition of the surrounding cooling medium, it may be stated that the rate of change of temperature at each instant is proportional to the difference between the actual temperature of the machine at that instant and the final maximum temperature which it would attain after the lapse of an infinite length of time. If t represents the time, C the maximum change in temperature, and c the instantaneous temperature, then the following relation may be said to hold:

$$\frac{d\,c}{d\,t} = \frac{C - c}{T}. \qquad (1)$$

In this equation T is a constant depending for its value upon the mechanical dimensions of the machine and the facilities for cooling, and may be designated as the heating time constant. It may be shown that T is equal numerically to the time which would be required for the temperature of the machine to reach the final value if all of the heat generated were conserved within the machine, i. e., without any dissipation whatever for this length of time.

Solving the above equation there results:

$$t = C - \frac{C}{\epsilon^{\frac{c}{T}}}, \qquad (2)$$

where ϵ is the base of the natural system of logarithms. Equation (2) is evidently that of a logarithmic curve. It is worthy of note that the subtangent of any logarithmic curve is a constant, and that, with the curve at hand, that constant is T, the heating time constant.

In the accompanying cut (Fig. 1), the straight line represents the rate of increase of temperature which would take place if the heat were not conducted away, the distance T indicating the time to reach the final steady temperature, which temperature under actual

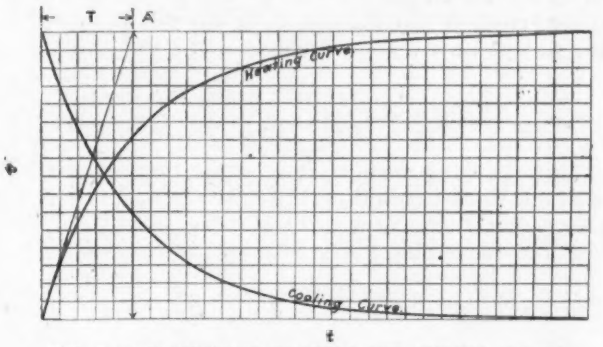


FIG. 1.—LOGARITHMIC HEATING AND COOLING CURVES.

operation would be reached only after an infinite length of time. The heating curve is obtained from equation (2). The cooling curve is obtained as the exact inverse of the heating curve, on the assumption that the machine had reached the maximum temperature at the instant when cooling began. In order to calculate the final rise of temperature with a machine which is operated intermittently with a particular time load factor, it is desirable to have a knowledge of both curves.

It will be of value to evolve formulas for the time constants of open-type armatures and the corresponding field coils. Assuming that the entire heat generated is conserved within the machine it will be observed that the final temperature rise may be expressed as

$$C = T\,\frac{H\,g}{H\,c} \qquad (3)$$

where $H\,g$ is the amount of heat generated within the machine per unit time, and $H\,c$ is the amount of heat stored in the machine per unit change of temperature, i. e., $H\ c$ is the heat capacity of the machine.

The heat capacity is proportional to the volume, and the volume of an armature may be taken as roughly proportional to D^2l, where D is the diameter and l the length. In a commercial machine the permissible generation of heat depends upon the surface area and the peripheral speed, and the relation may be expressed as

$$\frac{W}{D\,l} = (D\,S + b)\,k \qquad (4)$$

where W is the watts lost, S is the speed in revolutions per unit time, while b and k are constants.

The time constant may be expressed as

$$T = \frac{D^2\,l\,k}{D\,l\,(D\,S + b)} = \frac{k}{S + \frac{b}{D}} \qquad (5)$$

From experimental data on open-type machines, the formula for T may be expressed in minutes as

$$T = \frac{36{,}000}{S + \frac{2{,}000}{D}} \qquad (6)$$

The constants of formula (6) are based on a maximum rise of 40° C. above the surrounding air. If the speed is taken to be zero, formula (6) reduces to $T = 18\ D$, with equation may be said to hold approximately for the armatures of completely enclosed machines.

For the field coils of open-type machines the following formula can be employed:

$$T = \frac{72}{\left(\frac{\Delta}{100}\right)^2} \qquad (7)$$

where Δ is the gross current density in the field copper when expressed in amperes per square centimeter. For a certain maximum temperature rise (40° C.) the current density can be expressed as a function simply of the winding depth, to wit:

$$\Delta = \frac{210}{\sqrt{d}} \qquad (8)$$

where d is the winding depth in centimeters of the field coil at right angles to the axis of the coil.

Combining equations (7) and (8), there is obtained the following expression for the heating time constant of the field coils:

$$T = \frac{7.2}{(2.1)^2} d = 16.3\, d \qquad (9)$$

In equation (9), T is again expressed in minutes, the final temperature rise being assumed to be 40° C.

If an "hour-rating" plan is adopted for a certain overload, the final temperature rise (for infinite time) is determinable from the watts dissipated per unit of radiating surface. Thus with the time constant known, and the final temperature rise calculated, the actual temperature rise after a run of an hour can be read off from the logarithmic curve. To this end the curve of Fig. 2 can conveniently

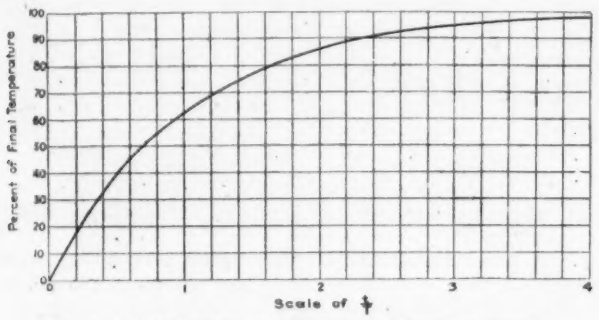


FIG. 2.—PERCENTAGE LOGARITHMIC HEATING CURVE.

be employed. The ordinates of this curve are the percentages of the final temperature rise, while the abscissæ are the ratios of actual time to the time constant as expressed by the quantity $\frac{t}{T}$.

Some New German Electric Projection Apparatus.

By C. J. Smith.

Some of the most interesting and unique devices for electrical projection of transparent and opaque bodies, as well as for colored projection, combined with searchlight and lantern effects, have recently been devised in Germany.

A great deal of important experimental work has recently been performed in color photography, and this subject has attracted the attention of many well-known scientists. After producing the negatives and projecting the views through screens of three different colors at the same time, the pictures are made to appear in their natural colors. The construction of a new three-color lantern is shown in Fig. 1. This three-color projection apparatus was designed by Prof. Miethe and was constructed by the Goerz Actien Gesellschaft, of Berlin-Friedenau, Germany. It consists of three objectives arranged side by side and three sets of slide holders mounted in front of a housing containing three focusing arc lamps.

Through the switchboard shown in the illustration current is supplied to the three projecting arcs from cables connected with binding posts on the lower edge of the marble panel. Above these connectors are three levers which vary the resistance in series with the arc lamp by means of rheostats mounted on the back of the board. The switches controlling the current are mounted in the center of the board and three ammeters of the Siemens & Halske type indicate the amount of current passing to each of the arc light circuits. The current used varies from 10 to 35 amp., according to the density of the negative. If the same amount of current is used in each arc lamp, the three colors (red, green and violet) pro-

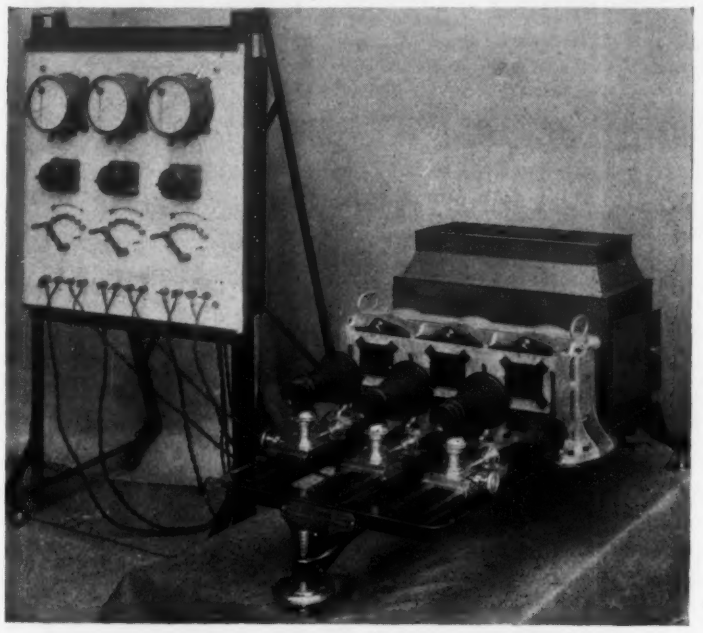


FIG. 1.—MIETHE THREE-COLOR PROJECTION APPARATUS.

jected on the screen through the slides balance each other and produce the picture in its natural colors, if the negatives have been taken properly and the lantern slides have been made correctly. Most beautiful sunrise and sunset effects may be produced as well as beautiful moonlight scenes from the same slides by changing the amount of current used in the arc lamps, thereby projecting the red or green colors so as to cause the one or the other to predominate.

FIG. 2.—LAMP USED AS PROJECTION LANTERN.

FIG. 3.—LAMP USED AS SEARCHLIGHT.

The accompanying illustrations (Figs. 2 and 3) show the arrangement and details of construction of a new combined focusing lamp for color projection, searchlight and lantern service as built at Berlin by the Siemens-Schuckert Werke. By operating this apparatus in the position shown in Fig. 2, stereopticon slides may be utilized as well as revolving color screens of various hues for projection upon a screen or a moving figure. By turning the projection apparatus as shown in Fig. 3, it may be utilized as an ordinary spot light or searchlight for theatre or other similar service with color screens as indicated.

The barrel is of sheet steel 280 mm. in diameters, and is provided with a focusing arc lamp usually operated with a current of 20

amp. The mirror has a diameter of 233 mm. and a focal length of 11 cm., and is of silvered copper construction. The condensers consist of two plano-convex lenses having a focal length of 10.5 cm. and a diameter of 12 cm. The objective is achromatic and consists of four lenses combined with a focal of 12.5 cm. This German projection apparatus is certainly most unique in construction, as it can be utilized with ease in either position shown, and for the purposes above mentioned. It is so constructed as to be fastened to a table by a clamp provided for the purpose, or mounted upon a tripod, as found most suitable for the purpose.

The epidiascope is a most interesting electrically-operated optical device constructed by Carl Zeiss, of Jena and Berlin, Germany, for the projection of objects lying in a horizontal position. The accompanying drawing, Fig. 4, shows the apparatus employing reflected light in the case of opaque objects, while the diagram, Fig. 5, shows the paths of the rays by transmitted light with transparent or translucent objects. As compared with a large projection outfit with an optical bench, the epidiascope is said to possess several characteristic advantages. There is a greater latitude in the shape and size of objects and when reflected light is employed the illumination is more perfect. The transition from operation with reflected light to transmitted light is effected with greater speed and convenience, and the apparatus is easily adjusted for projection upward, while the several components are better protected against dust and improper usage. The epidiascope is about 1.5 meters long with a total height of about 1.5 meters. The width of objects to be projected cannot be more than 30 cm. and the maximum thickness must not exceed 16 cm., while the construction of the apparatus prescribes no defined limits to the length of objects.

A focusing arc lamp is used as the source of light, adjusted according to requirements for a current of either 30 or 50 amp. A continuous current is indispensable to obtain satisfactory results, and, allowing for resistance at the terminals, the potential should

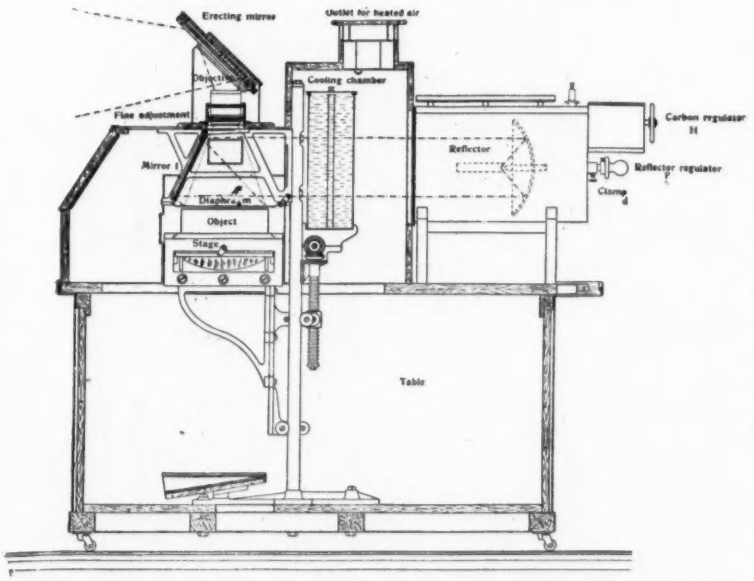


FIG. 4.—DIAGRAM SHOWING PATH OF RAYS BY REFLECTED LIGHT.

be about 65 volts. As however the currents supplied by power-distributing centers are usually of higher potential, either being 110 or 220 volts, this voltage must be reduced by a rheostat.

The diagram (Fig. 4) illustrates the procedure by reflected light called episcopic projection. The light emitted by the crater of the positive carbon falls upon the parabolic mirror of the lamp and is thence reflected in the shape of a nearly cylindrical pencil. It next passes through the cooling chamber, which if filled with water absorbs the heat rays, then strikes the mirror, *I*, and is by it reflected obliquely from above through the diaphragm and upon the object immediately below. From the object the light is diffusely reflected upward. Of the reflected rays only those which are confined in their passage to the space marked off by the dotted lines reach the objective. The cone of rays traveling upward through the objective meets the erecting mirror and is finally reflected upon the screen. The drawing, Fig. 5, illustrates the procedure by transmitted light called diascopic projection. The mirror, *I*, is here turned back, allowing the pencil of rays to pass to the mirror, *II*. From there it is reflected obliquely downward upon mirror *III*, which again reflects it vertically upward into the condensing lens situated below the object stage. Leaving the condenser, the rays of light pass through the transparent object forming a reduced image of the searchlight reflector near the projection objective.

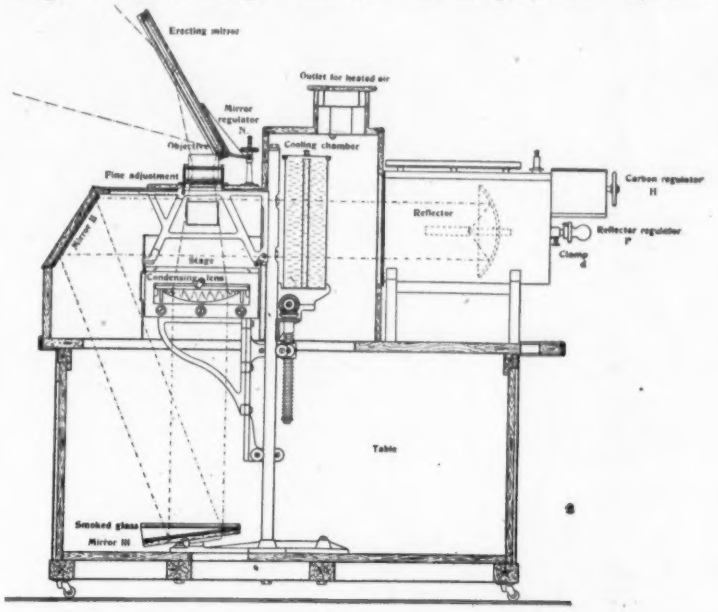


FIG. 5.—DIAGRAM SHOWING PATH OF RAYS BY TRANSMITTED LIGHT.

They next pass through the objective and meet the erecting mirror. The latter is shown in the illustration as fitted with a regulator. The position of the mirror as here shown is that required for projecting the picture obliquely upward.

Congress of Swedish Engineers.—II.

BY ARVID WESTERBERG.

A paper on "Investigations on Iron and Steel for Electrical Purposes," was presented by Mr. F. A. Enström. In order to study the influence of chemical composition and of manufacturing methods on the iron and steel used in electrical machines and transformers, G. Dillner and Mr. A. F. Enström have made, at the Testing Institution of the Royal Technical University of Stockholm, a series of investigations, of which Mr. Enström now gave a short account. The researches had been made on sheet iron and on cast steel. The desired property of the former is a low hysteresis loss, and, in order to keep down the eddy current losses a high electric resistance is valuable. The main requirement in cast steel, which is used for pole pieces, is a high permeability.

The instrument used for the researches was the Du Bois magnetic precision balance, which was accurate within some tenths of a per cent. With this instrument many different kinds of iron and steel, chiefly Swedish and German had been examined. At first, samples were taken from the open market and later special samples, made expressly to contain different percentages of silicon and aluminum were ordered. In casting the silicon steel it was observed that, with a percentage of this element above 1.5, the shrinkage of the steel was so great that cavities were difficult to avoid, while with about 1 per cent of aluminum there was no difficulty in casting the steel. With higher percentages of this element, however, the steel becomes rather thick, and from this cause many of the samples were unsound and unsuitable for testing. A chemical analysis of all the samples was made, the percentage of carbon, silicon, manganese, phosphorus, sulphur and aluminum being determined. The results obtained may be stated as follows:

For sheet iron it was found that the coercive force and the Steinmetz hysteresis coefficient is proportional to the carbon percentage within the range of 0.5 per cent. Thus it is obvious that a small amount of carbon is favorable in laminated iron for armature cores and transformers. As to cast steel, there is not produced any detrimental effect by increasing the carbon percentage, so far as is shown by the present investigations. With the very highest carbon percentage met with, about 0.30, the values

of the maximum induction and of the permeability at the usual induction in field poles, cannot but be considered as quite satisfactory. A high percentage of carbon produces an increase in the electrical resistance.

An increase of silicon causes a quite noticeable increase of the coercive force and of the hysteresis energy loss and also of the electric resistance, while the properties of permeability, remanence and maximum induction hardly undergo any alteration. Therefore, for sheet material, silicon should be avoided, while in the case of cast steel some silicon in the material may be advantageous owing to its raising the electric resistance. More than 2 per cent, however, should be avoided, because there will be a tendency to form cavities.

It has been stated that an addition of aluminum quite noticeably reduces the hysteresis loss, whilst it increases the electric resistance, and thus reduces at the same time the eddy-current loss. It has been found, too, that an addition of aluminum will reduce the maximum induction and the permeability for ordinary saturation values. The general conclusion is, therefore, that an addition of aluminum improves sheet material which is to be used for constructing dynamos. As regards cast steel, the matter is different. With such a high percentage of aluminum as is required in order to increase the electric resistance to an effective degree, the magnetic properties will be too much affected, and it must be agreed that the usefulness of aluminum in cast steel is questionable, to say the least. It is of interest, however, to notice the results obtained from the researches on cast-steel rods containing both silicon and aluminum. In this case low hysteresis losses are found, to be ascribed, no doubt, to the influence of aluminum, whilst the influence of this element on the permeability and maximum induction seems to be neutralized by the addition of silicon. The addition of silicon and aluminum together seems thus to tend towards a general improvement of the magnetic properties.

Mr. C. Benedicks has given a formula for calculating the electric resistance of iron from the number of atoms present of any element, which is contained in the iron in solid solution. This formula has been tested, and the agreement between the figures observed and those calculated may be considered very close.

It has been found that, as a rule, annealing improves the magnetic properties in general, and especially decreases the hysteresis loss. As to sheet material that had been annealed in packs, a decided difference amounting to about 10 per cent in favor of the edges was found between the edges and the centre, regarding coercive force and hysteresis loss. These researches prove, therefore, that the general assumption that the edges contain a lower grade of material than the center, is false. The time and temperature of the annealing is very important, 147° F. seeming to be the best temperature.

During the discussion following the reading of the paper, the question of the aging of the material was brought up, and it was pointed out that the aging depends largely on the annealing. If the annealing is carried out at the proper temperature the danger of aging is very small. Regarding the advisability of annealing the laminated packs after punching it was stated that Swedish and German manufacturers have abandoned this method which, however, is still in use in America and England.

A paper was presented by Mr. E. Danielson, dealing with "Single-Phase vs. Commutation Motors." Three types of such motors have characteristics suitable for railway work, viz., the series motor, the repulsion motor and the compensated repulsion motor. After giving a short description of these three types, Mr. Danielson made a comparison between them. The sparking being the greatest stumbling block in the operation of all commutator machines, the first comparison was made in this respect. The cause of the sparking in an alternating-current motor is two-fold: The one that exists in direct-current machines by the rapid change in the direction of the current in the short-circuited winding, and the one that arises by induction through the alternation of the flux passing through the short-circuited winding. The higher the speed of a machine the greater the difficulties which arise at a certain amperage from the first named cause. The difficulties of commutation from the other cause depend at a certain frequency upon the number of flux that passes through the short-circuited winding. When the motor is stationary the latter is the only cause for the sparking. When running the series motor and the repulsion motors operate equally as to the difficulties of the first class, since with each the sparking is inclined to increase at increasing speed. Regarding the second class of sparking a great difference exists between the different types of motors. With the series motor, at increasing speed, the strength of the field and at the same time the lines of force that have an inducing effect in the short-circuited winding decrease and, therefore, this class of sparking decreases at increasing speed. With the repulsion motor the sparking decreases as the speed approaches synchronism, and at synchronism it totally disappears, but when the speed is above synchronism, the sparking increases very rapidly. Therefore, above synchronism the sparking of a repulsion motor increases from two causes, while with the series motor, one cause of sparking increases and the other one decreases, as the speed increases above synchronism.

If the two types are compared regarding the iron losses, the result is analogous. Above synchronism they increase rapidly in the repulsion motors, but decrease slightly with the series motors. The conclusion from these comparisons is that the series motor operates well at speeds far above synchronism while the repulsion motor works best in the immediate neighborhood of synchronism. Consequently the series motor is fit for a lower frequency; and since the tendency to sparking is less at such frequencies, there is a considerable advantage for the series motor. Therefore, regarding sparking, one may say that the series motor for low frequency is the best single-phase commutator motor existing at present.

For railway work the repulsion motor is generally considered best for frequencies above 25 cycles. The difference between the simple repulsion motor and the compensated one lies principally in the compensation of phase that the latter gives. Since in railway work a considerable air-gap generally is required, the compensated type in most cases has to be chosen in order to avoid too great an angle of lag of the current.

Mr. Danielson compared direct-current motors and alternating-current motors, especially regarding their behavior at starting. The direct-current motor requires a starting rheostat; the alternating-current does not, but this advantage of the alternating-current motors should not be exaggerated, and its importance depends upon the frequency. The lower the frequency the more favorable is the relative economy at starting of an alternating-current motor—above 30 periods it is hardly probable that the start is more economical than with a suitable direct-current motor.

Regarding the torque per voltampere at starting, Mr. Danielson gave the following formula for single-phase commutator motors:

$$K = W \frac{P}{n} . C$$

where K = torque in kg at one meter radius.
W = kilo-volt-amperes.
P = number of pairs of poles of the motor.
n = the frequency.
C = a constant.

The size of the constant C depends on the air-gap, the peripherical length of the pole, the shape and numbers of the slots, etc., and is generally between 16 and 24. The value refers to the torque per kilo-volt-ampere at start, which is 1,25 to 1.85 times the torque per kilo-volt-ampere at synchronous speed.

In general, it may be stated that for railway work the series motor is best adapted, if the frequency can be chosen at will, but it has the disadvantage that a transformer of a size corresponding comparable with the size of the motor or the motors has to be carried on board the car or the locomotive. Therefore, it is suitable for large locomotives, for railways where the frequency can be chosen at will, and where considerable variations of speed occur, especially if the trains on a portion of the road should be fed with direct current.

The compensated repulsion motor can be used for the highest frequencies. It can be constructed almost without regard to those factors that generally determine the angle of lag, therefore a mechanically good machine can be made with large air-gap and high-tension windings on the stator. The compensated type is more complicated than the simple type, however, and necessitates a transformer for the compensating current. It is most suitable in those cases where a high frequency must be used and a large angle of lag would be very undesirable, and in those cases where the motors must work with small peripherical speeds or large air-gaps. Finally Mr. Danielson mentioned that the Allmänna Svenska Elektrishka Aktiebolaget is experimenting at present with a large motor which works as a series motor for alternating currents at higher speeds and for direct current, while for alternating current at lower speed it works as a compensated repulsion motor.

Recent Electrochemical Developments.

ELECTRIC FURNACE.

The electric induction furnace for making steel is not such a recent invention as is generally believed. E. A. Colby took out the first fundamental U. S. patents for the same in 1890 and he was the first person to build an induction furnace; while almost simultaneously the engineering firm of Sprague, Duncan & Hutchinson independently experimented with an induction furnace of their own construction. It is now easily understood why those early experimenters experienced difficulties—it was not on account of any inherent weaknesses of the principle of this type of furnace, but because of the backward state of alternating-current engineering in those days. The induction furnace is in principle nothing but an alternating-current transformer, the molten bath forming the single-turn secondary. The difficulty is one of design.

When Kjellin in Sweden began his work with the induction furnace a few years ago, the state of the art was very different; the proper design of ordinary transformers was then well understood. This remark should not be taken as an attempt to minimize Kjellin's work; its importance cannot be denied since he was the first to make the induction furnace a commercial apparatus for the manufacture of high-class steels which are equal in quality to crucible steels and are sold in competition with such. Yet, even now the design of the induction furnace presents difficulties, and a principal one is indicated in a patent recently granted to F. A. Kjellin. It is the difficulty of preventing the insulation of the primary winding from being damaged by the heat of the secondary melting chamber. To overcome this difficulty, Kjellin proposes to water-jacket the primary winding.

In a recent patent, granted to F. Bölling the following method is proposed for making molded blocks and articles of various shapes from silicon carbide. The article is first made of pure carbon, and is then embedded in finely powdered silicon carbide and subjected to strong heat whereby the surface of the carbon article "absorbs" the silicon carbide.

Articles made from fused quartz some time ago made their appearance on the market. They are useful for various purposes of industrial chemistry, since they are little liable to attack by acids and are wholly refractory. Moreover, not only can they stand high temperatures, but their coefficient of expansion is so small that when heated to a very high temperature they may be plunged into water without suffering any injury. Of course, the production of such articles requires a very high temperature. In a recent patent of E. Hart the electric arc is made use of for this purpose. A mold of the desired form is prepared and a small quantity of crushed quartz is first placed in the centre of the mold and fused together by the heat of the arc. Then more crushed quartz is added and fused and the article is gradually built up.

New Telephone Patents.

RECEIVERS AND TRANSMITTERS.

To overcome the breaking of receiver caps of hard rubber or composition, Mr. W. J. Murdock, of Boston, Mass., has devised and patented a receiver with a rigid ring of tough material set in and surrounding the cap to receive the force of sudden blow. Fig. 1 illustrates the idea.

In the usual types of transmitter we find carbon electrodes, carbon granules and a small, narrow air space about the diaphragm. Mr. J. Prince, of Milford, Mass., however, has produced a transmitter almost at direct variance with this. He provides magnetic electrodes, granules of magnetic iron ore mixed with carbon and a large resonating chamber about the diaphragm to increase its sensitiveness. It would of course—at first sight at least—appear to increase its ability to pick up and maintain the natural periods of the diaphragm. This may be overcome to some considerable extent, as the electrode chamber is pressed into the diaphragm itself at its middle. The inventor explains that the magnetic qualities produce internal energy which assists in preventing packing.

Another new transmitter has been patented, this by Messrs. P. J. Spies and R. C. Deuben, of Chicago. Their invention lies in structural details. The aerial face plate carries a ring flange over which slips a clamping ring which clamps the diaphragm to the face of the flange and which is integral with the bridge.

W. B. Curtis, of San Francisco, has worked out a new antiseptic mouthpiece. The usual rubber transmitter mouthpiece is perforated with two rings of holes near its base, and these lead into a chamber which is slipped over the mouthpiece base and is clamped between the flare and the transmitter face. This chamber carries the antiseptic material.

In order to improve the efficiency of transmission of party lines, a device has been patented by which all signaling apparatus may be removed from the line. This is accomplished by a sealed pneumatic chamber containing a heating coil. This coil is supplied at all

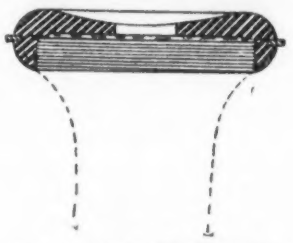


FIG. 1.—MURDOCK RECEIVER.

stations, save those with receivers off the hook, with current, the heating effect of which expands the air in the chamber. The cover of the chamber, being flexible, bulges under the influence of the pressure and thereby actuates a cut-out switch.

SAFETY CORD AND SET.

Telephones used upon lines strung on poles carrying high-tension currents, a condition often existing along electric interurban lines, at times become most disagreeable or even dangerous, because of leakage to, or static charges induced upon, the telephone lines. To prevent this danger, Mr. F. R. McBerty, of Chicago, has provided a complete protective apparatus for such instruments. All ex-

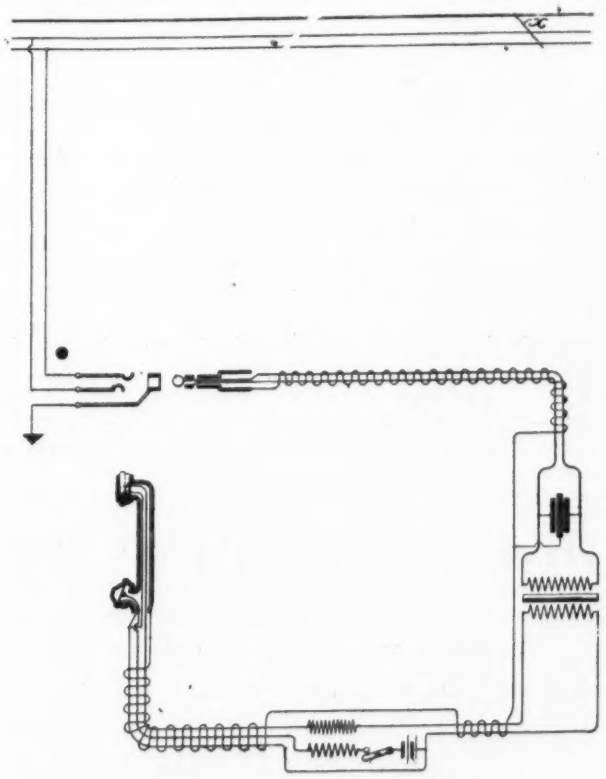


FIG. 2.—M'BERTY PROTECTIVE APPARATUS.

posed parts of the instrument liable to charge are connected to an extra conductor included in the cords, which conductor is spiraled around the working conductors between them and the outside of the cord. This extra conductor taps the middle or ground plate of an open space cut-out to which the line conductors are connected. Connection to the line is made through a plug and jack. This is a three-conductor type, the sleeve of the jack being grounded. As a further preventative of danger a repeating coil is inserted in the line conductors. This arrangement, shown in Fig. 2, provides about as complete precaution as can be desired. Mr. McBerty has assigned his patent to the Western Electric Company.

LETTER TO THE EDITORS.

The Application of Electric Power to Agriculture.

To the Editors of Electrical World and Engineer:

SIRS:—In your issue of September 16 Mr. E. W. Baker laments the backwardness of American manufacturers of electrical machinery in catering to the farming field. He directs attention to the fact that articles regarding apparatus for electric plowing as referred to in your index are mainly "made in Germany." It is true that American manufacturers of agricultural machinery have not been quick to avail themselves of electrical operation for their product. To our knowledge, however, two Americans are now working on motor-driven plows and a third party, now manufacturing steam traction plows, is inclined to take up experiments along this line.

Most of the articles published on electric plowing in Germany reveal plows which involve the use of a carriage pulled backward and forward over the field by motor-driven drums mounted on trucks and located at opposite sides of the field. An American inventor has taken up the work of an automobile plow, deriving its power from a motor mounted on the plow; the cable conducting the current is trailed along the ground. In this way, a great deal of expense for machinery is obviated and the amount of necessary labor reduced.

If Mr. Baker will review again the published articles on electric motor drive for agricultural machinery in Germany, he will note, if his facilities for investigation are adequate, that the motor-driven equipments, almost without exception, are located on some of the large landed estates, or on independent farms adjoining such landed estates. It is a comparatively simple matter for the wealthy farmer with broad acres to install a central power and lighting plant and distribute his current over any convenient radius, supplying economical power for his own work and that of his neighbors.

The advance of the electric interurban railroad is a far more potent factor in reducing the cost of farm power than the development of water power. If the farmer can secure power from a traction company, he can eliminate the investment necessary to impound the water, the necessary controlling work, water wheels, generators and other machinery. If Mr. Baker will figure the first cost of an independent electric lighting plant, he will find that very few farms and farmers are able to afford the investment, even though its ultimate result will be of great economy. The American farmer is too busy paying for the replacement of his farm machinery, due to careless use and abuse, to be able to afford the cost of his own electric power and lighting station.

As regards the use of power from the lines of the long-distance transmission companies, the farmer will find few opportunities for economy. The number of farms to be served from high-tension lines is small even though such lines cover a great expanse of territory. The line of the transmission company too often traverses rough country unsuited to farming. The expense of transforming the current down to a voltage safe and practicable for farm use bars the farmers effectually from enjoying the convenience of electric-motor drive and the economies due to its employment.

The salvation of the American farmer in the use of electric current lies in installing motors with power from a trolley line. The trolley companies are willing in most instances to dispose of their power to farmers. It gives them a power load which is practically without cost for the production of current, due to the fact that the total of the load compared with the total generating capacity is very slight. As a matter of policy, the promoters of new interurban railroads can well urge the desirability of electric motor drive for farmers by appealing to the farmer's pocketbook and pointing out the economies of electric motor drive for farm work. The right-of-way parties can easily secure concessions from the farmers and farm communities which would not be granted ordinarily, due to ill-founded hostility to traction corporations.

We know of several instances where farmers are considering the installation of a central electric station to serve several farms within a short radius. Such installations would be put on a co-operative basis and would enable each of the farmers to participate in the convenience and economy of electric motor drive and illumination for farm and home.

It is interesting to note the number of farmers in the Dakotas who propose converting the head of water from their artesian wells into electric power. Unfortunately, though this has been actually done, the well drillers give an exaggerated idea of the power available to the farmers; and investigation reveals immediately the minute power available. There are exceptions, of course, but the average artesian well cannot be considered a practical power proposition.

The American farmer need not look to Congress to relieve him from coal bills. What he wants to do is, if possible, to secure power from an interurban railroad. If no electric power is available, the proper thing for a farming community to do is to install its own central power and lighting plant.

The amount of water power available in the United States for farm work is not at all proportionate to the requirements. The scope of the water power plant is limited to a greater extent than that of the trolley company, as the former has greater transmission possibilities than to serve isolated farms. The ordinary water power transmission company does not usually follow lines which would enable it to serve numerous farmers. The trolley line, on the other hand, is projected to reach as much as possible the various communities requiring transportation facilities, and thus passes very near to the farmer, who can thus arrange to use the electric power available. The average farmer's requirements for power will not exceed 15 or 20 horse-power. Thus the long-distance transmission company will operate at a disadvantage when compared with the trolley company, which is far closer to its possible power consumers.

MADISON, WIS. NORTHERN ELECTRICAL MFG. CO.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Determination of Air-Gap Reluctance.—SMOOT.—A paper illustrated by diagrams describing an experimental method for determining the magnetic reluctance of an air-gap of given shape. The method is based on the parallelism which exists between Ohm's law for electric circuits and for magnetic circuits. The author first measures the electric resistance of a metallic template, the outline of which is a section of the air space in question. He then measures the resistance of a simple rectangular template of the same metal. Now the ratio of these electric resistances will be the same as the ratio of the magnetic reluctances for similar sections of air space, hence it suffices to calculate the magnetic reluctances of a rectangular air space, corresponding to the above-mentioned rectangular metal template. By multiplying this magnetic reluctance with the ratio before determined the magnetic reluctance of the odd-shaped space is obtained.—*Jour. Western Soc'y Eng.*, August.

Booster.—FRIEDLANDER.—In an article on direct-current machinery at the Olympia Electrical Exhibition in London, the author describes a reversible booster for charging and discharging batteries, invented by Turnbull & McLeod and built by the Lancashire Dynamo Company. This booster has a completely laminated field structure to allow rapid changes of flux to take place, and is fitted with four field windings: (1) a shunt winding across the booster brushes tending to keep the sum of the battery and the booster voltage equal to the line voltage whatever may be the state of the battery; (2) a main winding in series with the battery and the booster armature, compensating for the booster armature reaction; (3) a shunt winding connected across the mains, and (4) a series winding carrying a current proportional to that of the main generators, and acting in opposition to the current in the shunt winding (3). The combined effect of these windings can be arranged either to keep the output of the main generators constant at any desired value, or else to allow the generator current to rise and fall, within certain limits, in proportion to the external load, while the battery looks after the whole, or the greater part of, the variations from the normal external load—discharging at times of overload and becoming charged when the

external load falls below the normal. The booster is capable of giving at 120 volts continuously 200 amp., or for one hour 300 amp., or at 60 volts 400 amp. for five minutes, all at 800 r.p.m.—Lond. *Elec. Eng.*, September 29.

Commutator Grinding Machine.—In a report of the electrical exhibition at Olympia, London, the Philips grinder is described and illustrated. No driving motor is required, the grinding spindle being driven directly by means of a specially prepared rubber friction wheel running on the commutator. The spindle is carried by a strong slide and is absolutely rigid. Bearings of great length are fitted, and the spindle and drum are evenly balanced so as to run at the necessary high speed without causing vibration. When working the grinding spindle moves to and fro across the face of the commutator, and is automatically reversed at each end, and is so constructed that stops can be set as in a planing machine, grinding the surface up to the connecting wires and back to the edge. All the attendant has to do is to watch the feed.—Lond. *Elec.*, September 29.

Lights and Lighting.

Miners' Safety Lamps.—Some notes on the use of electric lamps in mines. Holliday has made experiments which show that a 100-volt, 16-cp incandescent lamp heats a heap of carbon dust into which it is placed, within three minutes to such a temperature that it begins to smoke; with the same lamp it is possible to inflame the heap of carbon dust on which the lamp is placed within 25 minutes. Hall found that the 16-cp lamp placed on carbon dust and partly covered with it increased the temperature in a short time to such a degree that spontaneous combustion may start and the temperature continues to rise until the carbon will take fire even if the lamp has been removed in the mean time. It may, therefore, be that a miner places his lamp down for a few minutes and takes it up without suspecting that the damage has already been done and that fire will start in a short while. Another danger from incandescent lamps when used in an atmosphere containing explosive gases is due to breaking of the globe, so that the incandescing filament will ignite the gases. To prevent this danger Tommasi has devised a safety lamp in which the filament is contained in two globes. The circuit is automatically opened when either of these breaks. This lamp is illustrated.—*L'Eclairage Elec.*, September 23. (See E. W. & E., September 16, 1905.)

Luminescence.—Nichols and Merritt.—An account of an investigation of the luminescence of Sidot blende or phosphorescent zinc sulphide. This material seems specially suited to bring out the relationships that doubtless exist between different types of luminescence; for not only is this substance excited to luminescence by all known exciting agents—light, Röntgen rays, radium rays, cathode rays, etc.—but the stimulating effect of heat and the property possessed by the red and infra-red rays of suppressing phosphorescence, are exhibited in unusual degree. The present paper deals only with luminescence excited by light and by Röntgen rays. There is a remarkable similarity between the effects of ultra-violet light and those of Röntgen rays as exciting sources. In each case the chief luminescence is in the extreme violet, and is of short duration. But in each case also this is accompanied by luminescence in the green, which is relatively faint but of long duration. As is illustrated in numerous other cases, the Röntgen rays, when comparable at all with rays of light, are rather to be compared with ultra-violet light than with the rays of the visible spectrum. The authors also studied the phosphorescence spectrum during decadence. It does not seem that any change occurs in the form of the phosphorescent spectrum during decadence, and the authors are of the opinion that the behavior of Sidot blende in this respect is typical.—*Phys. Rev.*, October.

Luminous Phenomena in Incandescent Lamp Bulbs.—Fuerstenau.—It is well known that electric glow lamps which have not been in use light up with a faint blue light on rubbing them with silk or skin. The author has observed that the green fluorescent spots seen in Tesla and cathode-ray experiments are also seen on the glass of lamp bulbs, and electrodeless tubes when they are rubbed. If, after rubbing, a lamp is held in the hand or attached to a stand, a faint glow commences after 8 or 10 seconds. It proceeds from the foot of the lamp and at the same time the carbon filament glows with a faint yellow color over its entire length. This experiment, however, succeeds only with lamps made highly sensitive by long rubbing. A strong glow may be obtained by holding the rubbed lamp in one hand and approaching the other hand toward it. At the moment of contact the filament shines out brightly. A curious circumstance is that during this secondary glow the filament is as steady as when made incandescent by a current. When cold it is extremely sensitive to disturbances. A fine glow is produced by rubbing the lamp on the sleeve and then suddenly removing it, as in the electrophorus. A sudden redistribution of the electric quantities appears essential to the glow described.—Lond. *Elec.*, October 6; from *Annalen d. Physik.*, No. 9.

Clutch for Arc Lamps.—An illustrated description of a device of British make for the easy manipulation of arc lamps suspended from brackets or lofty ceilings so that by means of a wedge and suspension cord they may be lowered to the ground to be trimmed and again hauled up in position without an unsightly festoon of cable.—Lond. *Elec.*, September 15.

Power.

French Power Transmission.—A fully illustrated description of the Clermond-Ferrand power transmission. There will be six 1,200-hp generating units, but at present only three sets and two exciter sets are installed and in operation. Each turbine is designed for a fall of about 70 to 80 ft., a capacity of about 1,200 hp, and for a speed of 333 r.p.m. Three-phase alternators are directly connected to the turbines by means of flexible coupling. They have a capacity of 1,000 kw at a pressure of 1,000 volts and a frequency of 50 periods per second. For transmission the voltage is raised to 20,000 by means of single-phase transformers. The distribution system comprises a trunk connecting the power house with the principal receiving sub-station at Clermond, a high-tension branch between the sub-stations at Volvic and Mozac, and between Clermond-Ferrand and Pont du Chateau, and finally a series of 3,000-volt branch lines. The distance between the power house and the sub-station at Clermond is about 17 miles straight across country, but the length of the route taken by the transmission lines is about 18¼ miles. The line consists of six wires, of 0.315 in. in diameter, forming two three-phase systems which can work either separately or in parallel. At full load the ohmic loss is approximately 7 per cent (5,000 kw). By adopting metal lattice work on the transmission line it was possible to place them at great distances apart and thus to reduce the cost of insulators and to avoid the payment of rent when passing over private property. Further, each is constructed with a small base, a very important factor in this transmission scheme, since the country through which the line passes is split up into small allotments. The ordinary standard used at Clermond-Ferrand is designed for spans of 328 yards; this distance is the most economical and gives the least weight of iron per mile. The base of the standard measures about 24 in. by 24 in., and there is a distance of 79 in. between the centers of the two sets of wires; the weight of the standard amounts to 1,786 pounds. The type of insulators chosen has been in use on the Paderno-Milan lines for the last five years. The insulator consists of two parts, which, after being tested, are joined together by means of a cement having as a base litharge and glycerine. By this means it is possible to obtain an even thickness of porcelain and, in addition, there are no less than four vitrified surfaces between the wires and the metal bracket, a construction which greatly increases the dielectric qualities of the insulator.—Lond. *Elec.*, October 6.

Bavarian Water Power Plant.—An illustrated article on the utilization of water falls in the Bavarian Alps for the generation of electric power. It seems that there can be developed in that district a total of about 700,000 hp, of which about 10 per cent, namely 75,000 hp, has been developed (while in Switzerland and in the Austrian Alps, 350,000 hp or 15 per cent of the total available power has been developed). The water power plant of the calcium carbide works of Lechbruck is described. It contains four turbines having a total capacity of 2,000 hp (the amount of water being 40 cubic meters per second and the utilized fall 5.3 meters or 18 ft.). The turbines are directly coupled with three-phase generators.—*Elek. Anz.*, September 24.

Single-Phase Versus Polyphase Transmission Lines.—Watson.—For large traction schemes the advantages of single-phase systems with respect to the track work are so incontestable that, when the single-phase motor problem has been fully solved there will be no question of using any other system on electric railway schemes of any magnitude. Advocates of the three-phase system have claimed as an advantage a saving of 25 per cent in the copper of the transmission line over the single-phase system. The author criticises

this statement. If we assume that a single-phase system with 10,000 volts between its lines is comparable with a three-phase system having the same voltage between its lines, of course the three-phase system has the lower copper cost for the same efficiency. But this is not a fair basis of comparison when an overhead line is in question. The basis of comparison should be that the insulation between any one line and earth shall be the same. The insulators are the determining factor. The author shows mathematically that on this basis an equal power can be transmitted with the same efficiency over a single-phase as over a three-phase system if the weight of copper is the same. In comparing the cost of a three-phase system and a single-phase system, the following points must be considered. On the one hand, the prime cost of single-phase generators is higher than that of three-phase generators. On the other hand there must be considered the cheaper switchboard, fewer insulators and 33 per cent less labor required in erection of the overhead bare cable. As regards the running costs, it will hardly be disputed that the handling of the power station will be facilitated by a single-phase equipment; and with regard to outside maintenance, there would be only two lines to look after instead of three.—Lond. *Elec.*, October 6.

Electric Power Transmission in Metallurgical Works.—Jansen.—The conclusions of his serial discussing in a general way the applications of electric power transmission in metallurgical plants. In the present installment he discusses especially the use of steam turbines and of gas engines operated with blast furnace gas. He also gives several load curves.—*Stahl und Eisen,* August 1 and 15.

Charging Apparatus.—Collischonn.—An illustrated description of an electrically-driven charging apparatus for blast furnaces.—*Stahl und Eisen,* June 15.

Crane.—Egger.—A fully-illustrated description of an electric crane operating with high speed. The load is 10,000 kg. Detailed drawings are given.—*Zeit. f. Elek.* (Vienna), September 10.

Rolling Mills.—Ilgner.—A paper on problems of the electric driving or reversing rolling mills.—*Zeit. d. Oest. Ing. u. Arch. Ver.,* September 22 and 29.

Cleaning Blast Furnace Gas.—Sahlin.—An article on economies obtainable by the cleaning of blast furnace gas. To be used in gas engines, the gas should be as pure as possible, while when used in stoves and under boilers it does not require such a complete purity. Several types of apparatus for cleaning gases are described and illustrated.—*Cassier's Mag.,* October.

Traction.

Mountain Railroad in Switzerland.—Regelsperger.—An illustrated article on progress made with the electric railway to the top of the Jungfrau mountain, which has a height of 4,167 meters. On July 25 last a train ascended to the fourth station, Eismeer, situated at a height of 3,161 meters. Originally it had been intended to finish the road in 1905, but it will not be completed before several years. The total length of the line will be not more than 12.2 km., but enormous difficulties have to be overcome. It is an electric rack railroad of the Strub system. The gauge is one meter; the maximum grade is 25 per cent, the minimum radius of a curve in open air is 100 meters and in the tunnel 200 meters. Water power is utilized for generating the electric current. There are 6 turbines, two of 500 hp each and two of 200 hp each, and two 25-hp turbines for supplying the exciting current. Three-phase current has been selected in preference to direct current on account of better efficiency and lower initial cost. The weight of the locomotive with accessories is 13.4 tons. Each locomotive is provided with two three-phase motors made by the Oerlikon Company. Each motor develops 120 hp at 450 to 550 volts, when running at 750 r.p.m., the frequency being 38 periods per second.—*La Nature,* September 30.

Installations. Systems and Appliances.

Acton.—An article on the electric supply at Acton. The municipality has decided not to erect a generating station of its own, but to purchase electricity in bulk from the Metropolitan Electric Supply Company, and to distribute it in the district under its control. Accordingly, the company supplies two-phase current at 10,000 volts and 60 periods per second, the power being paid for on the maximum demand system. The current is changed into direct current in a motor-generator station which also contains a battery.—Lond. *Elec.,* September 22.

Protective Apparatus.—Neall.—An illustrated article on choke coils, their construction and application for the protection of transmission lines. The static interrupter is also described.—*Elec. Jour.,* October.

Wires, Wiring and Conduits.

High-Tension Insulating Materials.—Kinzbrunner.—An account of a series of tests on the ratio between thickness and dielectric strength of high-tension insulating materials. For presspahn this relation can be expressed by the formula $E = C\sqrt{t}$, where E is the disruptive voltage, t the thickness of the material in millimeters, and C a constant which is equal to the actual disruptive voltage of 1 mm. of the respective material. For different qualities of presspahn the value of C varies between 3,700 and 5,600. From the above law it follows that the thinner the insulating material, the higher its relative dielectric strength (disruptive voltage divided by thickness). For instance, the relative dielectric strength of a piece of presspahn of about 0.1 mm. is about 3½ times as great as that of a piece of about 1.4 mm. thickness. But it would be wrong to conclude that the insulating power of presspahn can be materially increased by laminating it, i. e., by subdividing it into several thin layers. The reason is the law $E_n = E_1\sqrt{n}$, where E_n, the disruption voltage of n layers of presspahn, E_1 that of 1 layer, and n the number of layers. This shows that the lamination of presspahn will have no effect whatever. Therefore with regard to the disruptive voltage it does not make the slightest difference, whether, for instance, we use one layer of presspahn, 4 mm. thick, or four layers, each 1 mm. thick. On the other hand it may, in some cases, be of advantage to subdivide a material into several thin layers, more especially in cases where the material is subjected to mechanical strains, such as, for instance, in bending through a small radius, etc. Thus, more especially for slot insulations, it would improve the electric resistance of the insulation if several thin layers were employed instead of one thick layer. Insulating papers and Manila paper also obey the law $E = C\sqrt{t}$; C varies for different qualities of ordinary insulating paper between 1,400 and 1,500, and is about 2,200 for Manila. But paper behaves differently from presspahn with regard to lamination. The dielectric strength of several layers of paper is nearly proportional to the number of layers. Paper should be used in very thin sheets, and in as many layers as possible. "Supposing we had to insulate a winding with paper, and that a space of, say, 0.36 mm. is available for the insulation. By using three sheets of paper, each of about 0.14 mm. thickness, the total dielectric strength of this insulation would be about 1,100 volts, while the dielectric strength of 12 sheets of 0.03 mm. thickness would be about 1,600 volts, i. e., nearly 50 per cent more. It must be mentioned that the surface of the paper tested was not glazed, the nature of the surface could, therefore, not have had an influence on the dielectric strength." Fig. 1 shows the relative dielectric strength (perforation voltage divided by thickness in millimeters) as function of the thickness; curve I relates to ordinary insulating paper, curve II to Manila paper.—Lond. *Elec.,* Sept. 29.

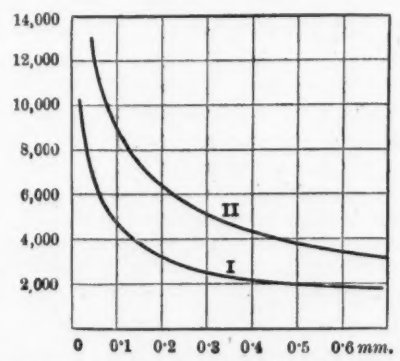


FIG. 1.—CURVES OF DIELECTRIC STRENGTHS.

Slide Rule for Wire Table.—Sakai.—An illustrated note telling how to use the slide rule on the wire table, with various examples.—*Elec. Jour.,* October.

Electrophysics and Magnetism.

Electric Conductivity of Flames.—Wilson.—A paper describing a series of experiments on the conductivity of a coal-gas flame for electricity between platinum electrodes immersed in the flame. The author applies J. J. Thomson's theory to his results. It appears that the conductivity of the flame is due to approximately uniform ionization taking place throughout the region between the electrodes, and further that the current is always very far from its maximum pos-

sible value even when a potential difference of 600 volts is applied to electrodes only one centimeter apart in the flame. The author then studied the effect due to the introduction of salt vapor into different parts of the flame. The current through the flame is not affected unless the salt vapor comes in contact with the negative electrode when a large increase in the current occurs. Absence of the effect except close to the cathode appears to be due to the non-uniformity of the potential gradient.—*Phil. Mag.*, October.

Radium.—SLATER.—A paper on the emission of negative electricity by thorium and radium emanations. In the case of thorium as well as radium, the emanation gives off a quantity of slow negative rays in changing to the excited activity. In air, at the ordinary pressure, these rays are rapidly absorbed, but at the very low pressures used in the experiments of the authoress, the rays reached the electroscope and discharged it. It is extremely probable that the amount of negative electricity given out by the emanation is considerably greater than the positive electricity emitted in the form of alpha rays. If this is the case, the residue from which the excited activity is derived must be formed with a positive charge, and its appearance on the negative electrode in an electric field is explained.—*Phil. Mag.*, October.

Magneto-Optics.—WOOD.—A paper on the magneto-optics of sodium vapor and the rotary dispersion formula.—*Phil. Mag.*, October.

ELECTROCHEMISTRY AND BATTERIES.

Hypochlorite Process.—A report by Alexander "upon the manufacture of electrolyzed salt-water (chloride of sodium and chloride of magnesium) for disinfecting purposes." He recommends the distribution of hypochlorite solution throughout the Poplar Borough (for which he is the "Medical Officer of Health") for deodorizing and disinfecting purposes.—Lond. *Elec.*, September 22.

Specific Heats.—RICHARDS.—In a continuation of his serial on metallurgical calculations he gives further data on the thermophysics of compounds, especially specific heats of chlorides, sulphides, silicates, etc.—*Electrochem. and Met. Ind.*, October.

Specific Heat of Gases.—HOLBORN AND AUSTIN.—An account of measurements of the mean specific heat of nitrogen, oxygen, air and carbon dioxide between 20 and 800 degrees.—*Phys. Rev.*, October.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Determining the Coefficient of Self-Induction.—PEUKERT.—A description of a simple method for measuring the coefficient of self-induction of a coil. *S* in Fig. 2 may be the coil to be tested; it is con-

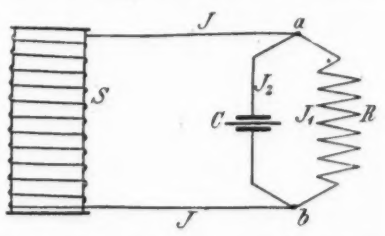


FIG. 2.—DIAGRAM OF TESTING APPARATUS.

nected in parallel with non-inductive resistance, *R*, and with a capacity, *C*, both being in parallel. If a sinusoidal e.m.f. $e = E \sin \omega t$ acts in this circuit, the current, *J*, will be in general not in phase with the e.m.f If now the capacity, *C*, and the resistance, *R*, are so adjusted that the current, *J*, and the e.m.f. *e* are in phase then $L = \frac{R}{\omega \sqrt{1 + \omega^2 C^2 R^2}}$. The author produces the sinusoidal e.m.f. in the circuit by means of transformer action, and this gives, at the same time, a simple method of determining whether there is phase difference or not between *E* and *J*. The method is shown in Fig. 3. The coefficient of self-induction of *S* is to be determined. *S* is placed on one side of the scales, and sufficient weight is placed on the other side to keep the scales exactly in balance. Below the coil, *S*, a secondary stationary coil is provided which is supplied with an alternating current. The capacity, *C*, and the resistance, *R*, are adjusted until there is no attraction between the coils, *S* and *F*. In this case there will be no phase difference between the induced e.m.f. and the induced current. The induced current is in quadrature with the inducing current; when the one is zero, the other is a maximum. *R* and *C* are, therefore, adjusted until the balance shows that there is no attraction between the two coils; then the values of *C* and *R* are read and the coefficient of self-induction, *L*, is calculated from the above formula. The advantages of the method are that no special apparatus are required, and that the method is highly sensitive, depending on the sensitiveness of the scales. If in the above formula

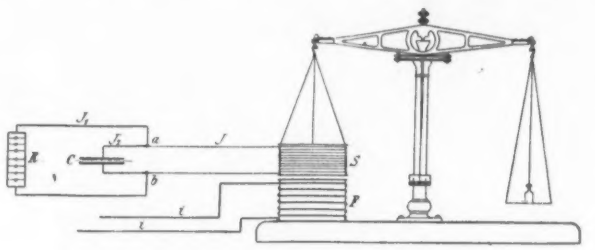


FIG. 3.—SELF-INDUCTION BALANCE.

for *L* the square root in the denominator is nearly unity then the coefficient of self-induction, *L*, is approximately $R \div \omega$.—*Elek. Zeit.*, October 5.

Contact With Dielectrics in Tests of Dielectric Strength.—APPLEYARD.—An account of experiments in which he first investigated whether tin-foil electrodes, pressed against a sheet of dielectric with India rubber discs, enable accurate determinations of dielectric strength to be made. The author finds that, except in the case of homogeneous dielectrics, it is misleading to deduce specific values referred to unit cube of the material from the results of tests of sheets. With tin-foil electrodes applied to tests of presspahn, the apparent dielectric resistance diminishes as the load increases and it attains a fairly constant value at a load of about 400 grams per square centimeter. Increase of voltage, especially with small loads, behaves like increase of load, apparently increasing the contact area and diminishing the observed dielectric resistance. When mercury electrodes are used, the dielectric resistance, as measured at different voltages, is sensibly the same even for abrupt and great changes of voltage.—*Phil. Mag.*, October.

Glow-Light Oscillograph.—GEHRCKE.—A description of his glow-light oscillograph, in which records of intermittent currents of high-frequency are photographed by means of the glow light between electrodes in nitrogen at 8 mm. or 9 mm. pressure. The new pattern of the instrument consists of two nickel plates mounted in the same plane with their edges only 1 mm. apart, but separated by mica plates. The discharge takes place between the edges, and is viewed end on, so as to get the maximum amount of light for the records. The latter consist of a series of impressions like marks of exclamation, the lower part being the bright positive glow light and the upper part the longer negative glow. The author obtained good records of low-tension alternating currents by superimposing on them a high-tension continuous current from a battery. The new apparatus is specially adapted for acoustic records, such as those of the Dolezalek siren. It is, of course, necessary to syntonize the circuit by introducing a suitable capacity and inductance. The author reproduces some records of the siren, one of them having a frequency of 1,880 periods per second, and the other a frequency as high as 4,660 periods. There is no inertia of moving systems to be reckoned with in the recording apparatus.—Lond. *Elec.*, October 6, from *Zeit. f. Instrumentenkunde*, September.

Cathode Ray Oscillograph.—RANKIN.—An article illustrated by diagrams and describing the Braun cathode-ray tube, as modified by Ryan, and its use for plotting various curves in commercial electrical engineering.—*Elec. Jour.*, October.

Fault Finding.—KNIGHT.—Two articles giving notes on mains, work and fault-finding. He describes methods of testing and fault-finding, for the localization of grounds and short-circuits.—Lond. *Elec. Rev.*, August 25 and September 1.

Meters.—GERHARDI.—Continuations of his illustrated serial. The author briefly discusses tram car meters and tells how to choose a type of meter for a certain purpose. He then discusses the arrangement of a meter department.—Lond. *Elec.*, Sept. 22 and 29.

Titration Voltameter.—KREIDER.—A description of a new voltameter in which the iodine set free at the anode is estimated by means of sodium thiosulphite in a burette. The precautions which are necessary to prevent the iodine from diffusing towards the cathode are described.—*Phys. Zeit.*, September 15.

Dry Cell.—Brown.—A description of a simple dry cell constructed on Daniell's principle from sheets of zinc and copper separated by sheets of fabric impregnated with zinc sulphate and copper sulphate, respectively, and with sheets of plain blotting paper as diaphragm. The cell has a fairly constant e.m.f. of "0.9 Daniell."—Lond. *Elec.*, September 15.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—Prasch.—An illustrated description of several new systems of wireless telegraphy. In the present installations the systems of Rochefort, Nevil Maskelyne, J. F. King are described and illustrated by diagrams.—*Elek. Neu. Anz.*, July 15 and August 15.

An Electrical Piano Player.

By S. Chester Lyon.

The piano player has come to stay. The piano itself is a device for mechanically and indirectly striking the strings of a harp. Since the introduction of further mechanism render easier the operation of striking the strings in the proper order and combination, such mechanism is artistically as justifiable as the keyboard.

Knowing the marvelous adaptability of electric mechanism, the ease with which it can cause and control motion, its, so to speak, flexibility, many must have wondered why it has not heretofore been applied to piano playing, displacing the cumbersome, unsightly pneumatic contrivances which, for want of something better, had such a vogue. In every other field of mechanical operation, where air is not wanted for some extra mechanical reason, electricity has been victorious. But up to the present in piano playing the pneumatic machines have monopolized the market. No account is to be taken of the pneumatic machines driven by an electric motor. The piano in such a case is still pneumatically operated. The sole useful function of the motor is the lessening of the physical fatigue of the performer. As a part of a musical whole the motor-driven player is inferior to the pedal-operated player, the control of expression given by the varying pedal action being lost.

In truth, the problem was not easily solved. Attempts at a solution had been made for over two generations by skilled mechanics without success. Yet when the solution was found, as seems to be the case with most remarkable inventions, it was very simple.

Let us first look at the simple underlying ideas. Imagine an electro-magnet placed underneath a piano, the armature of the magnet being linked mechanically to the key. It is clear that we can arrange so that the excitation of the magnet will cause depression of the key. It is clear also that a key at a distance may be used to close the circuit and excite the magnet controlling the key on the piano. And it is clear also that what we have imagined done for one key may be done for every key on the board. The realization of this idea would give us a piano operated electrically from a distant and separate keyboard.

We are still a long way, however, from a real electric player. Even the next important step, although dispensing with manual operation of the keyboard, stops far short of the satisfactorily operative electric player. The next step is the introduction of the music roll. Let us imagine the transmitting keyboard reduced in dimensions so that the distance between centers of keys corresponds to the distance between centers of adjacent lines of perforations in the ordinary paper music roll. If now such a roll be fed under such a keyboard it will act like the tape in a Wheatstone automatic telegraph, the circuit for any particular key being closed when a perforation comes under it and opened by the paper band. Such a roll and such a keyboard would, therefore, transmit to the piano every note cut in the roll.

The inventive work on the piano player passed through this stage and was arrested at it some time. But the sins both of omission and commission of such an instrument are numerous. The paper roll is wide and long; it changes in dimensions with the humidity of the atmosphere; it is easily soiled and torn, and in addition, when used as a circuit-breaker in an electric player it is liable to burn at the ends of the notes, thus gradually increasing their length or even running them together. Then, too, in such playing there would be nothing corresponding to the varying touch of the human fingers, no control of the pedals, none of the tempo. All this remained to be done. To get rid of the paper roll, the dimensions of the transmitting keyboard were still further reduced. This permitted, after much work had been done in securing an uniformly made and rolled metal, the substitution of a brass tape about five inches wide and three-thousandths thick, for the paper roll. This width is great enough to take in not only all the perforations for the keys ordinarily played, but also several sets of perforations controlling the expression devices to be described.

Going back to the primitive form of manually-operated transmitter

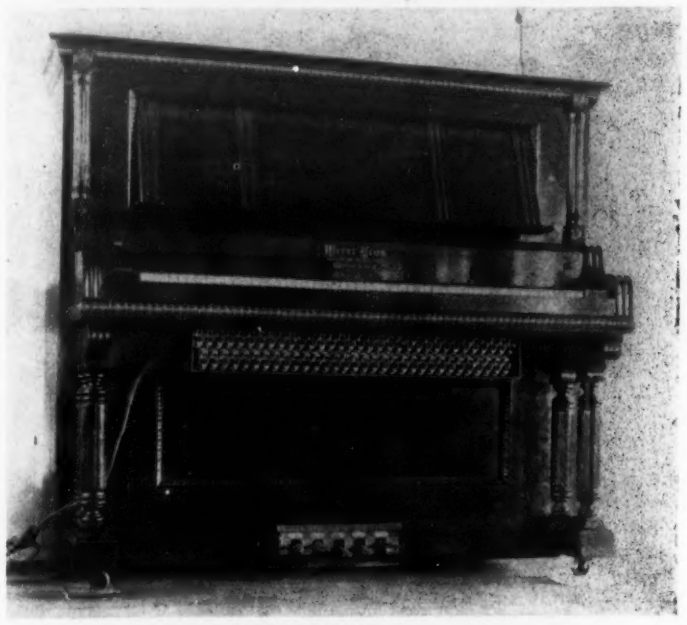


FIG. 1.—ELECTRICAL PIANO PLAYER.

first described, it will be clear that with a suitable magnet a variation in the pull on the piano key corresponding to the variation in touch of the human finger, could be secured by varying the strength of current and that this variation might be secured most readily by the use of a variable resistance in circuit. For the complete instrument, since the number of keys in action is variable, a separate set of resistances must be provided for each key. The finished instrument, therefore, for ordinary use, carries 65 tiny sets of resistance coils. These resistance coils are used in either of two ways to vary the touch. They may be cut in and out by hand at the will of the performer by the mere turning of a knob, or they may be controlled by the action of the music roll. To this latter end the music roll is provided with perforations similar in character to those used in operating the keyboard of the piano. In practice there are three rows of these perforations and three transmitting keys corresponding. According to the transmitter key in action, one of these magnets is energized and the motion of the armature of this magnet deter-

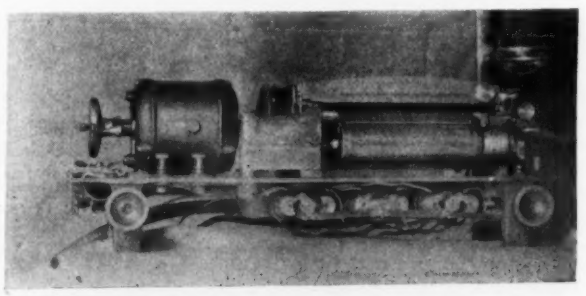


FIG. 2.—TRANSMITTER CLOSED WITH MUSIC ROLL.

mines the amount of resistance in circuit. The touch in this manner is under perfect control. In a similar way the pedals are operated by the action of the magnets attached to them, the action of these magnets being controlled by means of perforations in the music roll, or by hand at will by means of push buttons.

As to tempo, that also is either roll-controlled or variable at will by the turning of a knob. The music roll train is driven by a miniature motor. The speed of this motor is variable over a wide range by the turning of a knob which sets the governor.

The speed is steady at every setting. Arbitrary control over the tempo is had, therefore, by the movement of the knob. The nature of the material used for the music roll makes roll control possible. In the ordinary paper roll the material is so flimsy that further crowding of the notes is out of the question, while further spacing is negatived by the already excessive length of the roll. With brass, however, although the total length of the roll is only about one-third that of the corresponding paper roll, this difficulty does not exist. In consequence, pre-arranged variation in tempo may be produced by a variation in the spacing of the notes along the roll.

Of course, since brass is a conductor it cannot be used as a circuit-breaker directly. The brass roll is, in fact, excluded from the electric circuit entirely. The roll instead of making and breaking a set of electric circuits, acts to raise and lower a set of keys which are mechanically combined with, but electrically separate from, the electric keys. The electric keys are in this manner protected from friction and from all wear not incident to their proper function.

The apparatus naturally divides into two parts, the transmitter and the receiving instrument. The main portion of the latter is shown in Fig. 1 in connection with an upright piano. It consists of a box of magnets placed beneath the keyboard of the piano, there being a magnet for each key to be operated. A small screw eye is secured to each of the piano keys and this screw eye is connected to the armature of the corresponding magnet by a thin steel wire working in a rubber bushing. The armature is centrally pivoted and oscillates about the center. The force of the oscillation is dependent on the strength of the current and the latter on the resistance put in circuit. The forward oscillation of the armature, therefore, depresses the key with a force controlled from the transmitter by the resistance, the touch varying exactly as if the key had been fingered.

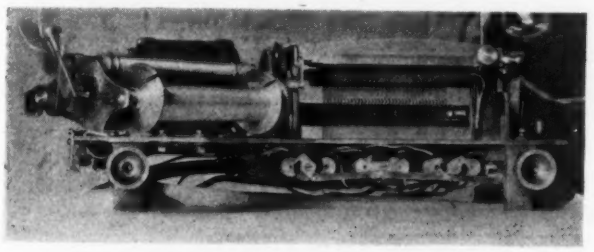


FIG. 3.—TRANSMITTER WITH MUSIC ROLL CARRIAGE SWUNG OUT.

One striking advantage of this system of connections is that the piano is left absolutely free at all times for manual playing in the ordinary way. There is nothing that has to be moved away, nothing that needs to be disconnected. It is impossible to determine by fingering the keys whether or not the magnetic attachment has been made. It is even possible to combine manual with electric playing, for instance one part of a duet may be played by hand and the other electrically. The pedal magnets are separately attached and are entirely out of sight.

Fig. 2 shows the transmitter closed without the music roll. Fig. 3 shows the transmitter with the carriage for the music roll swung out, and Fig. 4 shows the music roll in position in the carriage ready for playing. Fig. 5 is an end view showing the releasing magnet, whose function is explained below. Fig. 6 shows the cradle containing the electric keyboard and the resistance coils. Fig. 7 is a rear view of the transmitter. Fig. 8 shows the receiver attached to a grand piano and the little transmitter placed on a stand at a distance.

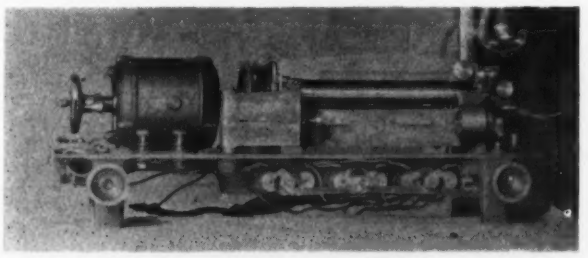


FIG. 4.—ROLL READY FOR PLAYING.

The electric keyboard contains besides the keys corresponding to the piano keys, others controlling the action of the pedals and the variation of the resistance. The pedal action being substantially the same as the key action, will be readily understood. The variation of the resistance governing the touch is effected as follows: The resistance coils are mounted in a pivoted cradle which carries also the electric keyboard, Fig. 6. One terminal of each coil is connected to the corresponding electric key. Against the face of each coil rests a spring wire leading to the cable which connects with the piano, Fig. 7. As the cradle is rocked the spring wire sldies over the face of the resistance coil, cutting it in and out of circuit. The rocking of the cradle is effected by the magnets seen at the base of the transmitter in the front view, these magnets being thrown into circuit by special keys on the electric keyboard.

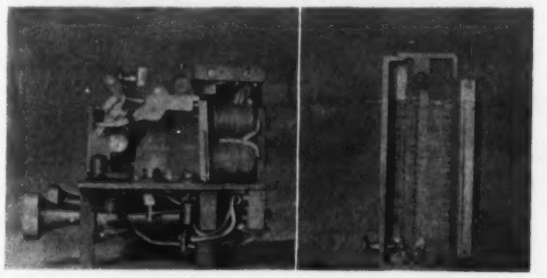


FIG. 5.—END VIEW OF CARRIAGE, SHOWING RELEASING MAGNET.
FIG. 6.—CRADLE WITH ELECTRIC KEYBOARD AND RESISTANCE COILS.

A special key when the roll has been exhausted closes the circuit on the trip-magnet seen in the end view. This causes a change of gear and a rapid rewinding of the music roll.

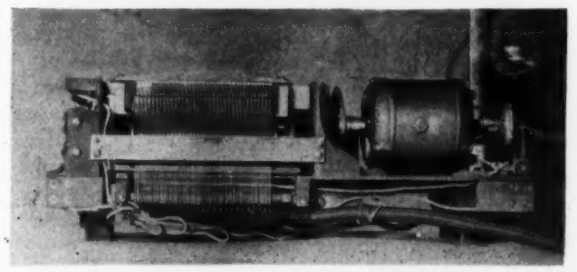


FIG. 7.—REAR VIEW OF TRANSMITTER.

As a purely roll-controlled self-player the Telelectric Piano Player varies the tempo, touch and pedal action to give any desired expression. The interpretation of any master may be expressed in the brass and will be faithfully reproduced in music. For those who desire to use their own interpretation there are provided means which give full, complete and easy control. In the front view of the transmitter will be seen two knurled knobs and in the center of each a push button. The knob at the left controls the governor of the motor and hence the tempo. Any particular tempo may be secured or the tempo may be varied indefinitely with no more trouble than is required to turn the knob. The knob at the right controls the resistance in the circuit and so gives power to delicately shade the touch. The button in this knob, on being pressed, operates the soft pedal while that in the left hand operates the sustaining pedal.

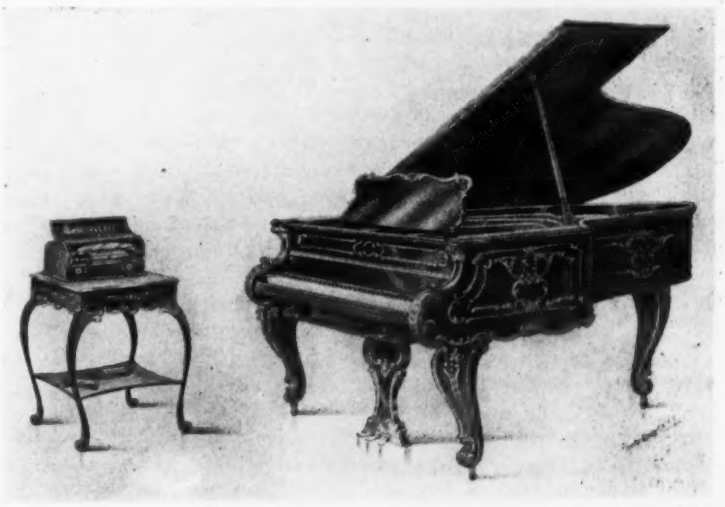


FIG. 8.—ELECTRIC PIANO PLAYER.

The control of the piano is as absolute as could be obtained at its own keyboard and no exertion is required. Individualized operation of the electric piano player calls for brains, not feet, as music is an expression of the emotions of the soul, not of the motion of the soles.

Modulating Electric Lamps.

BY W. J. PHELPS.

Hardly had the first pieces of carbonized paper and the first strings of conglomerated lamp black, and the first pieces of carbonized bamboo begun to shed forth their fitful and wattful light, when nimble inventors, long accustomed to the easily regulated oil and gas, began to think of some way to turn down the electric light.

In all candor it must be admitted that the incandescent lamp of early days was far more in need of some device to turn it *up*, than any contrivance by which its sickly red light might be turned down. It was very soon apparent that there were only two or three ways in which to accomplish this result. Resistance could be introduced in series with the filament, thereby cutting down the effective voltage at the filament terminals, and so cutting down the current passing through the filament, reducing its brilliance.

Several lamps of different candle-powers burning in parallel could be switched on and off, in succession, or these filaments of different candle-powers could be mounted in one bulb, and the filament of proper intensity selected at any time, by some complicated system of multiple inleading wires for the lamp, and switching mechanism in the socket.

Another method proposed was to maintain circuits of different voltages all through the house, and either switch a 16-cp filament from a higher to lower voltage or else provide miniature lamps burning on the lower voltage, which could be turned on when desired. One English inventor proposed to run two circuits of 110 volts and 5 volts through the house, using a system of 5-watt miniature lamps, burning on a separate circuit to give the low light when desired.

A variation of system No. 1 was proposed in mounting two 16-cp filaments in the same bulb, with connections by which these filaments could be burned singly, or in parallel or in series. When connected in series they result in the familiar dull red light. However, until recent years, of all the methods employed, doubtless the one in which an adjustable resistance connected in series with an incandescent lamp filament has received the most commercial exploitation, and the most industrious attention from the Patent Office. Patents in great number have been issued for "regulating" sockets. This method, however, fails of any commercial prominence, on account of the unsightly bulk of the apparatus, its average unreliability and the fact that it usually requires an electrician to install the same. The further fact that in the very most economical form, this method only results in cutting down the energy consumed 40 per cent at the lowest notch, has had possibly much to do with its lack of popularity.

The turn-down lamp as a business dates from the invention of the baby filament idea. In the words of the Patent Office, this involves, "in constant-potential lighting, one or more filaments connected within one bulb. The resistance of such filaments being so proportioned that when burned in series one at least of said filaments glows, while one at least of the filaments remains a relatively dead and dark resistance." It is well known that the cold resistance of an incandescent filament is approximately double its hot resistance, owing to the pronounced negative temperature coefficient of carbon.

Inasmuch as one of the objects of a turn-down lamp is to use an extremely small amount of current when the lamp is turned down, and the only way in which a small amount of current can be made to pass at the ordinary voltage is by using a large amount of resistance, it follows that resistance, however secured, is a valuable consideration.

The placing of the big filament in series with the baby filament makes it possible to reduce the dimensions of the latter by considerable, and really bring the same within manufacturing limits.

An incidental advantage of the series arrangement is that in any switching mechanism, the baby filament is shunted around the break, and thereby the sparking is almost entirely removed. In one commercial form in which the baby filament is generally known, the total watts of the nominal 1-cp filament burning in series with the big filament, ranges from 8 to 9. The same filament in combination with 8-cp instead of 16, uses a total power ranging from 5 to 6 watts.

Baby filaments have been made so small as to require only 3 to 4 watts, but it was found impracticable to continue their manufacture, on account of the very numerous breakages in handling such an attenuated carbon thread.

The uses of a turn-down lamp have from year to year enlarged in their importance. Where formerly it was supposed to be of benefit only in the nursery and sick room, it has come to be quite frequently adopted for *every* room in the house. Such use is based on common sense. It seems reasonable that the supply of any commodity should be regulated. If we were obliged to use water faucets in which the water must be turned on full or off entirely, it would be very inconvenient, even if the water cost nothing. If coffee were to be sold only in ten-pound packages, there is little doubt but that it would work great inconvenience, and probably reduce the consumption of coffee. While the average man usually installs a turn-down lamp as the result of some particularly large lighting bill, and for the purpose of cutting down expenses, he is quite likely to discover that he has secured a considerable addition to his personal comfort, and personal comfort, in spite of all our improvements and inventions, is still a most important item to be considered.

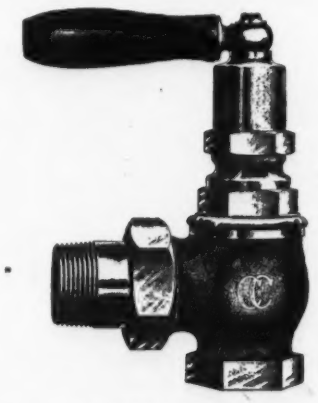
After a hard day's work it is often pleasant to sit in the low twilight of a 1-cp filament and rest the eyes. The artistic uses of a turn-down lamp are as yet practically unexploited. We are spending more and more money in our office buildings, our hotels and our homes for the "looks of things." The writer firmly believes that the time will not be far distant when "looks" will require in the lobby of a hotel, for example, that all the lights shall be turned down dim after 12 o'clock, rather than that a few bright burning 16-cp lamps shall spot the bleak darkness of the upper wall.

In the average office building the halls are maintained quite brightly lighted from 7 to 11 o'clock, for the benefit of about seven or nine men who happen to be working late at their desks. The effect is not beautiful, and the least amount of power which will maintain a decent light all through the halls and passages, is a considerable item in the expense of operating an office building. Turn-down lamps located properly through the halls would give a much better distribution of light for the same amount of power, and in all probability could be used to give light enough, and well distributed enough with considerable less power than is now used.

A joke carpenter recently declared that "Necessity is not the mother of invention; at least not in modern times," but that "Invention is the mother of necessity." It has often seemed during the past seven years to those exploiting a turn-down lamp, that "Invention is the mother of necessity." Whichever of them came first, it will not be denied now that the turn-down lamp is a permanent necessity in well-organized electric lighting, and destined to acquire more and more importance, no matter what form of light is used.

Quick-Opening, Self-Packing Radiator Valve.

The radiator valve shown in the illustration embodies in its construction several novel features worthy of note. It is claimed that



RADIATOR VALVE.

there is no possibility of the valve leaking at the stuffing box. By a special device, placed in the stuffing box, the packing is automatically kept tight and will last for years without renewal. The device

is very simple, consisting only of a vulcanized washer, located in the top of the stuffing box and kept in position by spring compression, which fully compensates for the wear on washer. These valves open and close by turning the lever handle one-half turn. The quick opening and closing feature will no doubt be appreciated by users who have operated old-style radiator valves. The lever handle can be operated by the foot, as well as by the hand. The construction of these valves is such that when closed the discs bear on the seats very tightly, and the valve is locked in place until released.

These valves are manufactured by the Crane Company, Chicago, Ill.

Doublejoint Desk Fixtures.

The illustrations herewith show two forms of the Ward double-joint desk lamp. As the name implies, there is a double-joint mechanism in the lamp stand. This mechanism is placed near the base, and there is a single-joint mechanism at the socket, which enables the light to be placed at any point desired within the range of the fixture, without loosening or tightening thumb screws or other devices. The joints are so constructed that they may be moved freely without straining or in any way injuring the flexible cord which is

FIG. 1.—BRACKET LAMP.

FIG. 2.—BOOKKEEPER'S PORTABLE LAMP.

concealed in the tubes. The lamps are constructed with a weighted base, as shown in Fig. 1, or with a desk clamp, as shown in Fig. 2. All lamps are fitted with telescoping tubes similar to those used in Kinsman fixtures, making them suitable for small or large desks.

These desk fixtures are manufactured by the McLeod, Ward & Co., 27 Thames Street, New York.

Portable Direct-Current Voltmeters and Ammeters.

The accompanying illustration shows a type of instrument which has been designed to meet the demand for portable voltmeters and ammeters which would retain their accuracy notwithstanding the rough usage such instruments meet in practice. The instruments are intended for use upon direct-current circuits and are constructed upon the principle evolved by Marcel Deprez, the noted physicist of France, involving the use of a permanent-magnet movement without moving wire. This principle embodies the acme of simplicity and insures the most accurate indications.

The moving element is extremely light and all parts are made rigid and strong, with the idea of obviating damage by jar. Each instrument is enclosed in an iron case which, in turn, is enclosed in a hard maple case of attractive appearance, provided with a leather carrying handle. The materials entering into the construction are claimed to be of the best. The magnet is of a special tungsten steel, put through a rigid process for permanency. All wire is of ample cross-section, and the instrument may be kept in circuit indefinitely. A special feature has been embodied to aid in making a number of instantaneous tests all around some known point. This is a device controlled by a projecting button on the cover, and

DIRECT-CURRENT VOLTMETER.

limits the movement of the pointer between abutments. When not in use it is moved to the zero position.

These instruments are being placed on the market by the Troy Electrical Company, Troy, N. Y.

Welded Flanges for Steel Pipes.

The advantages of welded flanges for steel pipes are well known to engineers who employ steam, air, gas and water piping where leakage must be prevented, no matter what variation in pressure may occur. A welded flange is particularly appropriate for steel pipe because, when it is properly made, the flange and the pipe become one piece of metal. We are able to give below an outline of the process of manufacturing welded-flange pipes as carried out by the Ball & Wood Company, at Elizabeth, N. J.

The flanges are made of wrought steel of the same grade as that used in the pipe. The pipe is carefully tested and then specially prepared to receive the rough flange. This is placed on the pipe close to the end, and the flange and pipe are heated. The welding is done by machinery designed especially for the purpose, but the process is practically the same as that employed by the pipe makers in welding the seams or lap. When the process is completed the flanges are faced off and the back and edge turned down. Ordinarily all flanges and bolt holes conform to the standard for extra heavy flanges adopted on June 28, 1901, at a meeting of the valve and fittings makers of the United States. Special flanges of other dimensions are made on special orders, and they can be furnished with plain, tongue-and-groove and male and female faces, or with raised faces and with smooth lathe finish for grinding to a perfect joint. After completion each piece of pipe is tested under hydraulic pressure. There is no injury done to the metal, any more than in welding the seam, and the special equipment and methods of the Elizabeth shops are such that only the ends of the pipe are subject to working in any way, the greater part of the length not being heated or strained in any way. Special attention is given to the most minute details, such, for instance, as using a blacksmith's standard coke fire for heating rather than a gas furnace, which is a little harder on the metal, although it is employed in lap welding the seam of the pipe.

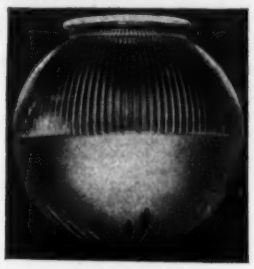
The company's shop, which was started up on July 15, has already furnished welded-flange pipe to the Detroit Edison station, the power plant of the Long Island Railroad, the Narragansett Electric Light Company and the Rhode Island Company at Providence—to mention only a few sales for important plants. It might also be added that about the strongest confirmation of the reliability of welded flanges is furnished by their use by the Otis Elevator Company for the cylinders of high-pressure elevators. This service is far more severe than that to which any ordinary piping is subjected, for the pressures sometimes run as high as 2,500 pounds per square inch.

In connection with flange welding, the Ball & Wood shop is also equipped for pipe bending. The demand for expansion loops offsets and other special work is constantly increasing, because all changes in direction made with fittings add joints to a pipe line, and joints should be avoided as much as possible, even at somewhat increased cost. In laying out bends there should be a short, straight length of pipe adjoining each flange, before the curve begins. On pipe less

than 4 in. in diameter this straight section should be at least 1½ diameters in length, and on larger pipe at least one diameter. Experience has shown that wherever practicable it is well to have the straight portion equal in length to at least two diameters.

Holophane-Pagoda Ball.

In the new million-dollar Syracuse Court House, perhaps the finest of its kind in the country, the question of having the lighting fixtures in keeping with the design of the rooms was taken up very carefully by the engineers and architects in charge of the building. The prime desire was to utilize to the fullest extent the advantages



PAGODA BALL.

of economy which can be obtained by modern lighting methods without, however, sacrificing in any way the artistic features. As a result the new Holophane-Pagoda Ball, a view of which is given herewith, has been adopted as a standard in 6-in., 7-in. and 8-in. sizes, no less than 900 of these being used on the decorative chandeliers. In cases where a much larger ball was necessary, owing to the fact that Pagoda Balls were not manufactured in such sizes, a ground glass ball has been specified. For what might be called "the useful light" fixture, Pagoda reflectors have been specified in every case, over 2,000 being employed. About one-half of the Pagoda Balls are to be furnished with a handsome cut-glass star on the bottom, which will add greatly to their appearance without detracting at all from their illuminating value.

Key-Socket and Shadeholder.

The electrolier key socket, shown in Fig. 1, is noteworthy in that it is most compact and has a finished appearance harmonizing well with decorated electroliers. It has a neat metal key which is thoroughly insulated from all live parts. This key is removable and an extension key may be used in its place.

FIG. 1.—ELECTROLIER SOCKET.

FIG. 2.—COMBINED SOCKET AND SHADEHOLDER.

The combined socket and shadeholder, shown in Fig. 2, is designed to replace the usual socket with the ordinary detachable shadeholder. The shadeholder in the new device is permanently attached to the socket shell in such a way that it cannot slide or turn. This, together with the fact that three points of support for the shade are afforded, instead of two as in the clamp shadeholder, eliminates any sagging of the shade. Both of the above appliances are made by the General Electric Company.

Waterproof Receptacle for Lamps.

An interesting electric lighting specialty is shown in the accompanying illustration. The globe, which encloses the lamp, is screwed tightly into the porcelain top. The joint, which is made, is not only

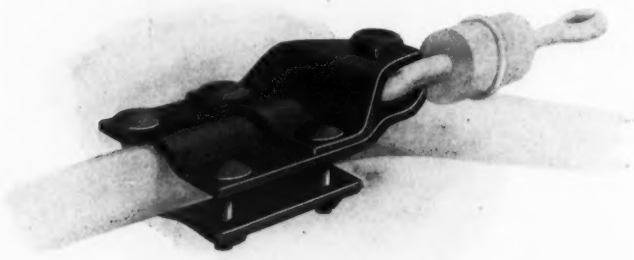
WATERPROOF RECEPTACLE.

water proof, but is moisture and dust proof, thus affording complete protection to the incandescent lamp. This receptacle is manufactured by the E. H. Freeman Electric Company, Hamilton Ave., Trenton, N. J.

Cable Clamp.

The Kearney cable clamp, which is shown in the accompanying illustration, has been designed to supplant the extra joints and fastenings necessary in the ordinary methods of cable suspension at angle poles and dead-ends. Two wrought-steel plates with four clamping bolts constitute the device. The two parts of the clamp are designed to fit the surface of the cable, and, when the nuts on the four bolts joining the two parts are tightened, the clamp grips the cable so that the pull is transmitted through the upper plate to a globe strain or similar insulator fastened to the pole at the curve. By the use of two of these clamps, one holding the cable in either direction from an angle pole, the curved portion of the cable between the two clamps will be relieved of any great amount of strain. This method of construction does away with the necessity for serving the heavy cable about an insulator at an angle pole, and then making a joint to continue the cable after it has turned the angle.

This cable clamp is made in but one size, suitable for cables from No. 0000 B. & S. to 1,000,000 c. m. cross-section. The manufacturers, W. N. Matthews & Bro., 227 North Second Street, St. Louis, state



CABLE CLAMP.

that in comparison with the usual devices a saving of from $10 to $15 per corner, dead-end or curve, can be made by the use of the Kearney clamp and also that a more perfect type of line construction can be had by the use of this device. In order to place this clamp upon the market this company offers to prepay the freight on trial orders of 25 or more clamps on condition that they are to be paid for if satisfactory, otherwise they are to be returned at the expense of the company.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of trade were not quite so uniformly good as they have been in the recent past; they were somewhat irregular, but industry is still at the top notch of activity. Heavy rains in the West and too much warm weather in the South have exercised some influence, but back of it all is the fact that a quieting down of wholesale trade should naturally be expected after three months of activity. Retail trade has received some stimulation from the colder weather, and jobbers are as a consequence doing more re-order business. Trade in the South has been benefited by the lifting of the quarantine restrictions, but the good effects have been partly neutralized by the holding of cotton for higher prices, which also retards collections. Car shortages are becoming more acute, the Pacific Coast now feeling their influence and shipments are being delayed, with effects on retail trade and collections. In the industries there is an unprecedented Fall demand. Shipments of coal are somewhat hampered owing to lack of cars. The activity in building operations, in the large cities and in the country, is beyond precedent. Cotton manufacturing is active and higher wages have been granted. Manufacturing for the holiday season is very active. In regard to the iron and steel industry, the *Iron Age* says the leading interests in the steel industry are more and more emphatically taking a position adverse to any violent upward price movement. They are endeavoring to keep not alone values of raw material within bounds, but are holding down prices on finished iron and steel. The markets for pig iron have stiffened. This week it is the East and the Central West which have marked up quotations. Some of the large Southern interests have practically withdrawn from the market entirely, but there is still some, though little, iron available on the basis of $12.50 for No. 2 at Birmingham. In the Central West the news of greatest interest is that the Steel Corporation has purchased 20,000 tons of iron for October delivery at $15.50 at furnace and 20,000 tons for November delivery at $18, thus establishing an advance. The quantities purchased, however, are smaller than expected. There has been further good buying in the Eastern markets and prices have been advanced to $16.50 to $16.75 at furnace for No. 2 foundry and $17.50 to $17.50 delivered for basic pig. A leading Buffalo interest has put prices up 50 cents per ton. The pressure upon the car builders and locomotive shops is enormous. It is figured out that there are contracts in sight for 80,000 steel cars, which include the 20,000 cars just being figured on for the Pennsylvania system. The locomotive builders are crowded and are covering liberally for their materials. One large interest has contracted for a total of 75,000 tons of bars, plates, etc. Lumber is active, large sales of white pine to be cut this winter being reported. Hardware and all other building material continues strong and active. There has been no change in the copper market, and little business was transacted. There was some inquiry for export. The market closed at 16¼@16½c. for Lake and electrolytic and 15⅝@16⅛c. for casting stock. The number of business failures for the week ending Oct. 19, as reported by *Bradstreet's*, was 178, against 183 the week previous and 227 the corresponding week last year.

DOBLE WATER WHEELS.—The Abner Doble Company, of San Francisco, has recently received several interesting orders for tangential water wheels. Prominent among them is an order from the California Gas & Electric Corporation for a 9,000-hp wheel for its de Sabla power plant. This machine will be similar to the 8,000-hp wheel installed in the de Sabla plant last year, and the three 8,000-hp Doble wheels recently completed and now successfully operating in the new Electra station of the same company. The wheel will operate under a head of 1,530 feet at 400 r.p.m. and will be driven by a single jet of water, thus making it the most powerful water wheel ever constructed for operation under a single jet of water. Another order from the California Gas & Electric Corporation calls for six 570-hp wheels for its Nevada City plant. These will operate under a 190-foot head at 410 r.p.m. A 400-hp wheel for operation under a 400-foot head, equipped with jet deflector operated by a Woodward compensating governor, has been shipped to the Chancellor Gold Mining Company, Wenatchee, Wash. The La Grande Water Storage Company, La Grande, Ore., has purchased an 800-hp, 1,150-foot head, 600 r.p.m. wheel, equipped with a Doble needle regulating nozzle for operation by a Lombard governor. Among other recent orders secured by the company are two double 1,750-hp wheels for the San Joaquin Power Company, Fresno, Cal., for operation under 385-foot head; one Doble needle regulating nozzle for a large water wheel for the Komata Reefs Gold Mining Company, New Zealand, and a double 700-hp water wheel unit for Mitsui & Company, Japan, for operation under 210-foot head, this order including the wheel complete with Lombard governor and gate valve.

TENNESSEE RIVER POWER.—Some details have already been given in these columns as to the plans of the Chattanooga & Tennessee River Power Co. Mr. John Bogart, the consulting engineer, in discussing the general possibilities of the great power plant, said this week: "The navigation of the Tennessee River is now impracticable at low stages of the water. The people of that section of the country have been anxious for years to improve navigation, but it has been impossible to get from Congress the large amount of money required. A contract for a lock and dam to entirely relieve navigation has recently been entered into between the Chattanooga & Tennessee River Company and the Secretary of War. The works to be constructed include a lock and dam, a massive power house, a transformer house and hydraulic and electrical installations sufficient to give an electrical output of 56,000 hp. The company has just agreed upon a contract with the W. J. Oliver Company, one of the largest firms of Southern contractors, for the construction of that part of the work which shall be performed at once, and this is to be followed by contracts for the installation of the hydraulic and electrical power and the transmission line to the City of Chattanooga and other localities in the neighborhood."

PRATT & WHITNEY IN CANADA.—It is announced that the Pratt & Whitney Company has purchased a plant in Dundas, Ont., for the manufacture of its full line of small tools—taps, reamers, milling cutters, punches, dies, etc., etc. This building is a modern structure, and the power plant is already in place. The machinery equipment is being got ready at Hartford, and will be sent on and operations begun immediately. The plant, we are informed, will also include a department for manufacturing a full line of twist drills, an elaborate equipment of special machinery having been gotten ready for the purpose. The location of the factory is near that of the John Bertram & Sons Company, which, as has been announced, was recently purchased by the Niles-Bement-Pond Company.

COPPER CYLINDERS.—In a decision written by I. F. Fischer, the Board of United States General Appraisers has overruled a claim filed by Welles & Locke of New York regarding the rate of duty applicable to copper cylinders produced by electrolysis. The board finds that neither Collector Stranahan's classification nor the claim of the importer is correct. It is held by the board that the merchandise is properly dutiable under the provision in the tariff law for articles not specially provided for. As the appellant failed to make this claim the protest was overruled.

EGAN TELEPHONE APPARATUS.—Mr. Charles Egan, of Illinois, has patented an apparatus for a new design of telephone transmitter and receiver which can be produced, it is claimed, at 50 per cent less than the old style. The Business Men's Association of Springfield is investigating the proposition with a view to tendering the Egan Electric & Telephone Company a free factory site in that city.

WATER-WHEEL GOVERNORS.—The Sturgess Governor Engineering Co., Watervliet, N. Y., report, among recent sales, an order for water-wheel governors and mechanically operated relief valves for the Wares Shoals Mfg. Co.'s plant at Wares Shoals, N. C.; also one 24-in. mechanically operated relief valve for the No. 7 unit of the Hudson River Electric Power Co.'s plant at Spiers Falls, N. Y.

ELECTRIC REFINING OF COPPER.—Negotiations are said to have been concluded for the lease of the Lake Superior Corporation's new copper plant at Sault Ste. Marie, Canada, to the Canadian Nickel Company, a new concern organized for the purpose of refining copper by electricity. Preparations are being made for the installation of the necessary machinery to carry on the proposed enterprise.

THE STROMBERG-CARLSON TEL. MFG. CO., Rochester, N. Y., reports having closed contracts for switchboards for the following places: Roxboro, N. C.; Onaga, Kan.; Rochester, N. Y.; Ellicottville, N. Y.; Eldorado, Ark.; Wabash, Ind.; Newark Valley, N. Y.; Camden, N. J.

ELECTRICAL PLANT WANTED.—The Hawkinsville Cotton Mills, Hawkinsville, Ga., W. N. Parsons, president, are in the market for a 200-kw alternator and a 250-hp Corliss engine. It is not necessary that they should be new.

ORDERS FOR GAS ENGINES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has received within the last few weeks many orders for gas engines, ranging from 10 b.h.p. to 1,000 b.h.p. No less than 36 gas engines are covered by these orders, aggregating 6,647 b.h.p. One of the most recent and significant orders was received from the Rockland Electric Company, of Hillburn, N. Y., for two 500-hp double-acting horizontal tandem gas engines. This company has already in operation three 19 in. x 24 in. Westinghouse double-acting gas engines direct-connected to generators, and this second order serves as a testimonial of its satisfaction with the use of gas engines as prime movers. Another order worthy of special mention is one from the Union Traction Company of Kansas, Independence, Kan., for one 500-hp horizontal-tandem gas engine and one 1,000-hp horizontal twin-tandem gas engine, both for alternating current generator driving in parallel. Other orders were received from the Sherwin-Williams Company, Newark, N. J.; American Sheet & Tin Plate Company, Pittsburg, Pa.; The Sidney Electric Light Company, Sidney, Ohio; J. C. Sterns Electrical Company, Buffalo, N. Y.; American Snuff Company, New York City; Northwestern Lithographing Company, Milwaukee, Wis.; Granite City Hospital, Granite City, Ill.; American Locomotive Works, Allegheny, Pa.; American Acid & Alkali Company, Bradford, Pa.; Amolyo Mining Company, New York City; Home Light, Heat & Power Company, Pittsburg, Kan.; Pittsburg (Pa.) City Hall; Dr. C. F. Bingham, Pittsburg, Pa.; Automatic Electric Company, Chicago, Ill.

PLANT PROPOSALS INVITED.—The Breese (Ill.) Water & Light Company has decided not to attempt to get its new lighting plant in operation before Christmas, as originally intended. All of the bids received on Oct. 9 have therefore been rejected, and new proposals are invited for 10 a. m. Monday Oct. 30. Victor J. Klutho is architect and William H. Bryan is consulting engineer, both of St. Louis. The work is divided up as follows: Section A, building, brick walls, concrete floors, composition gravel roof; Section B, one new boiler, 60x20, with forty-four 4-in. tubes, f.o.b. Breese; Section C, erection of boiler in position, also delivery of two old boilers from old pumping station, 9,000 ft. distant, and erection in new power house, with brick work and boiler and engine foundations; Section D, two 150-hp side-crank, self-oiling engines for direct connection to 100-kw alternators, erected on foundation; Section E, pipe work, heater, pumps, for connecting engines, boilers, etc.; Section F, electrical apparatus, including two 100-kw, single-phase alternators, 2,300 volts, 60 cycle, switchboard and station wiring, 35 arc lamps, and regulators, also converters; Section G, two triplex power pumps, 15,000 gallons per hour each, with 25-hp motors, delivered and erected in position with pipe and wire connections; Section H, distribution section, including poles, primary and secondary lines and erection of converters and arc lamps. Further particulars may be had by addressing either the engineer or architect.

SEPTEMBER FOREIGN TRADE.—The statement of imports and exports for September, issued by the Bureau of Statistics, shows an increase of $18,005,485 in the imports for that month over the figures for the same month last year, an increase of $2,738,707 in exports and a decrease of $16,266,778 in the preponderance of exports over imports. The balance in favor of this country, although much smaller than last year, was about $5,000,000 over the balance for September, 1903. The imports and exports of merchandise for the month and for the nine months ended with September compares as follows with the figures for last year:

	September	
	1905.	1904.
Imports	$102,138,031	$84,132,546
Exports	136,005,822	134,267,115
	Nine months	
Excess exports	$33,867,791	$50,134,569
Imports	$872,548,988	$751,376,116
Exports	1,102,575,831	985,470,972
Excess mdse. exports	$230,026,843	$234,094,856

STANLEY-G. I. CONTRACTS.—The Atlanta office of the Stanley-G. I. Electric Manufacturing Company has recently closed the following contracts: Alabama City, Gadsden & Attalla Railway Company, Gadsden, Ala., one 120-kw inductor alternator, with switchboard, exciter and one 50-light alternating-current series arc system; city of North Birmingham, Ala., one 250-kw inductor generator, switchboard and exciter; Capital Light & Power Company, Jackson, Miss., one 250-kw inductor alternator, exciter and switchboard; Guthbert, Ga., one 60-kw inductor alternator; city of Geneva, Ala., one 80-kw. inductor-type alternator, exciter, switchboard and series street lighting system; city of Monroe, Ga., one 120-kw revolving-field alternator, exciter, switchboard and series street lighting system; the Sheffield Company, Sheffield, Ala., one 125-kw rotary converter, transformers, switchboard, etc.; city of Tallahassee, Fla., one 50-light series street lighting system.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was irregular, but showed a rallying tendency toward the end of the week under professional manipulation in a few issues. Traction stocks and industrials were the chief features, special attention being given to the equipment stocks and to a remarkable advance in one of them, American Locomotive common, to 68¼. The Steel stocks were also strong, though featureless. Bonds were steady with limited dealings. All of the electric and traction securities were strong and active and a large business was done. Allis-Chalmers common and preferred made a net gain of 1¾ points each, the former closing at 19⅜ and the latter at 62⅛. The sales of common aggregated 27,700 shares and of preferred 15,900. General Electric made the largest advance of all—9¼ points. The sales of this stock were unusually large, aggregating 19,900 shares, and the range of prices was between 179 and 189¼, the closing quotation being 188¾. The activity in General Electric and Allis-Chalmers was due to recently revived rumors affecting the relations between these two interests. Westinghouse also shared in the active market to the extent of an 8¾-point advance. Its lowest price of the week was 169½ and the highest 176¾, which was also the closing quotation. American Locomotive was active, 258,100 shares of common having changed hands at prices ranging between 59⅜ and 69, the closing quotation being 68⅛, which is a net gain of 7¾ points on the week. Preferred closed at 116, a net gain of 2¼ points. In the traction list, Brooklyn Rapid Transit was by far the most active, the sales aggregating 908,400 shares. The closing price was 78½, a net gain of 6⅜. Metropolitan Street Railway was comparatively quiet, and closed at 127¼, a net advance of 1¼. Interborough Rapid Transit was the exception and closed on the curb market with a net loss of 1½ points at 212½. Western Union was a shade lower, closing at 93¼, while American District Telegraph, which is usually classed as an inactive stock, received unusual attention and made a jump from 35 to 40, on sales of 1,700 shares. Electric Storage Battery made a net gain of ¾-point, closing at 84½. New York & New Jersey Telephone closed at 170. Prices on the curb market recovered in sympathy with values on the Stock Exchange and for the most part are higher than a week ago. Chicago Subway was a notable exception. It broke over a dozen points on further liquidation from many sources, particularly by the pool, but it recovered about half the loss. It is understood that much of the stock thrown over went into strong hands. Rather more attention than usual was given to low-priced stocks, but no new developments occurred in that connection. Following are the closing quotations of October 24:

NEW YORK

	Oct. 18	Oct. 24		Oct. 18	Oct. 24
Allis-Chalmers Co.	17⅝	20⅝	General Electric	179	188¾
Allis-Chalmers Co. pfd.	59¾	63⅜	Hudson River Tel.	..	..
American Dist. Tel.	33	39¾	Interborough Rap. Tran.	214¾	212¼
American Locomotive	..	68¼	Mackay Cos.	46	46
American Locomotive pfd.	..	116	Mackay Cos. pfd.	72½	73¾
American Tel. & Cable	92	92	Marconi Tel.	..	..
American Tel. & Tel.	137	136	Metropolitan St. Ry.	125⅝	125½
Brooklyn Rapid Transit	72¾	78	N. Y. & N. J. Tel.	..	..
Electric Boat	30	30	Western Union Tel.	93	92¾
Electric Boat pfd.	70	70	Westinghouse com.	168	174
Electric Vehicle	15½	15	Westinghouse pfd.	..	..
Electric Vehicle pfd.	23	23			

BOSTON

	Oct. 18	Oct. 24		Oct. 18	Oct. 24
American Tel. & Tel	137¼	138	Mass. Elec. Ry. pfd.	56	56
Cumberland Telephone	122	122	Mexican Telephone	1¾	1¾
Edison Elec. Illum.	..	*249	New England Telephone	138	138¼
General Electric	179	189	Western Tel. & Tel.	14	13
Mass. Elec. Ry.	13¾	13	Western Tel. & Tel. pfd.	*95	90

PHILADELPHIA

	Oct. 18	Oct. 24		Oct 18	Oct. 24
American Railways	52	52	Phila. Electric	8¾	8⅝
Elec. Co. of America	11	11⅛	Phila. Rapid Trans.	28⅛	27¾
Elec. Storage Battery	82	84	Phila. Traction	..	..
Elec. Storage Battery pfd.	..	..			

CHICAGO

	Oct. 18	Oct. 24		Oct. 18	Oct. 24
Chicago City Ry.	..	200	National Carbon	..	60
Chicago Edison	..	..	National Carbon pfd.	..	116
Chicago Subway	41	..	Union Traction	12⅜	..
Chicago Tel. Co	137	..	Union Traction pfd.	..	..
Metropolitan Elev. com.	..	28⅛			

* Asked.

LIGHTING IN CHICAGO.—Chicago dispatches say: LaSalle Street was puzzled over the news of the incorporation of the Metropolitan Gas & Electric Company until it was learned that the new venture had not been started for the object of competing with the present Chicago gas companies. The new corporation, which has a capital stock of $12,000,000, has at its back several Chicago capitalists, and its purpose is to take over gas and electric plants in cities of medium size throughout the country. At present the promoters are said to hold options on plants in several cities, and as soon as the organization is perfected negotiations will be opened with a view to obtaining the securities and systems of flourishing gas companies. The articles of incorporation were taken out in Delaware. The promoters are Joseph C. Markley, of Chicago; George F. Goodnow, of Waukegan, and Harry Davis, of Wilmington, Del.

ELECTRIC LIGHT EARNINGS.—Stone & Webster report the earnings for the month of August of the following companies controlled by them:

	1905.	1904.	Increase.
Edison Electric Illuminating Company, of Brockton:			
Gross	$10,314	$8,165	$2,149
Net	2,376	2,606	*229
Surplus over charges	1,647	1,743	*95
El Paso Electric Company:			
Gross	22,763	20,775	1,987
Net	7,057	6,775	281
Surplus over charges	3,335	3,448	*112
Jacksonville Electric Company:			
Gross	23,995	23,828	166
Net	8,605	10,131	*1,526
Surplus over charges	5,371	7,114	*1,743
Lowell Electric Light Corporation:			
Gross	18,286	17,279	1,006
Net	6,204	6,811	*607
Surplus over charges	5,507	5,654	*147
Savannah Electric Company:			
Gross	51,164	49,931	1,232
Net	21,036	22,555	*1,519
Surplus over charges	10,482	11,911	*1,428
Houghton County Electric Light Company:			
Gross	14,249	11,873	2,375
Net	6,019	4,128	1,890
Surplus over charges	3,832	1,941	1,890
Minneapolis General Electric Company:			
Gross	53,178	43,510	9,653
Net	20,134	18,121	2,012
Surplus over charges	11,063	8,609	2,453
Tampa Electric Company:			
Gross	29,060	30,009	*949
Net	11,290	13,056	*1,765
Surplus over charges	9,405	11,171	*1,765
Terre Haute Traction & Light Company:			
Gross	58,049	54,426	3,628
Net	23,915	22,110	1,804
Surplus over charges	12,917	12,470	446

*Decrease.

LIGHTING IN FARGO.—Announcement is made of the sale of the stock owned by the Messrs. William and Sinclair Mainland, respectively, of Oshkosh and Green Bay, Wis., in the Union Light, Heat & Power Company, of Fargo, N. D., after negotiations which have been pending since last July. The buyers of the stock are Paul Doty, St. Paul; J. W. Smith, Fargo, and George H. Prince, St. Paul. The new officers of the company will be: President, Paul Doty; vice-president, J. W. Smith; secretary, O. G. Barnes; treasurer, J. W. Smith. General Manager Markhus will retain that position just as long as he wants it. President Doty, who is very well known to central station men, said that he and those associated with him considered Fargo an important center, growing and very progressive. There would be no change of policy whatever in the conduct of the business of supplying gas and electricity. The Mainlands had been progressive, and this was known far and wide, and it would be continued just as they had established it. Those gentlemen had done exceedingly good work and given Fargo first-class plants in the way of gas works and electric light plant.

THE BELL IN PENNSYLVANIA.—The Central District & Printing Telegraph Company, the Bell concern of Pittsburg, has effected a long-term traffic agreement with the South Penn Telephone Company, of Waynesburg, whereby the 1,700 telephones in Greene County are given access to the trunk lines of the Bell Company. By this deal the Bell concern ties up the company for a long period and blocks any attempt to gather up the independent companies into one large concern. The Tri-State, Consolidated, National and Federal Telephone companies of that end of Pennsylvania and a portion of West Virginia, and which have more or less been identified with the Pittsburg & Allegheny Telephone Company, the largest independent interest in this district, are cut off from service in Greene County. M. C. Rorty, superintendent of the Bell Company, gave out the following statement: "The deal as a whole is the immediate outcome of a disagreement between the South Penn Company and neighboring independent telephone companies, and interrupts communication between a number of these companies. Several other similar deals will shortly be concluded."

DIVIDENDS.—At a directors' meeting of the Crocker-Wheeler Company the regular quarterly dividend of 1½ per cent was declared last week. The directors of the Henry R. Worthington Corporation have declared the regular semi-annual dividend of 3½ per cent on the preferred stock, payable Nov. 1. The Twin City Rapid Transit Company has declared a quarterly dividend of 1¼ per cent, payable Nov. 15. The American Graphophone Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Nov. 15. The directors of the Cambridge Electric Light Company have declared a regular quarterly dividend of 2½ per cent, payable Nov. 1. A quarterly dividend of ¾ per cent is declared on the capital stock of the Northern Texas Traction Company, payable on Nov. 1. The directors of the East St. Louis & Suburban Company have declared a dividend of 1 per cent, payable Nov. 1. The regular quarterly dividend of 2 per cent on Automatic Electric capital stock is payable Nov. 1. The directors of the American Light & Traction Company have declared the usual quarterly dividends of 1 per cent on the common and of 1½ per cent on the preferred shares, both payable Nov. 1. The directors of the International Steam Pump Company have declared the regular dividend of 1½ per cent on the preferred stock, payable Nov. 1.

NIAGARA, LOCKPORT & ONTARIO.—At a meeting of the stockholders of the Niagara, Lockport & Ontario Power Company held at Lockport, control of the company passed from the Lockport men into the hands of the Westinghouse-Albright interests, which are behind the Ontario Power Company of Niagara Falls, Ont. A new board of directors was elected as follows: Herman H. Westinghouse of Pittsburg, George C. Smith of the Westinghouse Company, Robert E. Drake of Syracuse, Paul T. Brady of Syracuse, J. J. Albright of Buffalo, S. M. Clement of Buffalo, C. A. De Guersdorf of New York, William H. Gratwick of Buffalo and Edmund Hayes of Buffalo. The last five represent the Albright interests and the others the Westinghouse interests.

LONG MISSOURI TROLLEY.—A syndicate has been formed consisting of Thomas Nevins & Son, of New York, and Denison, Prior & Co., Cleveland, to construct a high-speed electric railway for the transportation of freight and passengers between Kansas City, Mo., and St. Joseph, Mo., with branches to Leavenworth and Atchison, Kansas, which will have approximately 100 miles of track when completed. The company will construct a bridge across the Missouri River and will enter Kansas City over the tracks of the Metropolitan Street Railway Company, effecting a saving in time to St. Joseph passengers of from forty to fifty minutes. The company will have $5,000,000 stock and $5,000,000 bonds.

N. Y. & N. J. TELEPHONE STOCK.—It is proposed by the New York & New Jersey Telephone Company to make an increase of the capital stock of the company from $15,000,000 to $50,000,000 at the special meeting for that purpose, and offer new stock at par to present stockholders up to 25 per cent of their holdings. The capital stock outstanding is $13,917,600, leaving an unissued portion of the $15,000,000 already authorized amounting to $1,082,400. The amount necessary to make an offering to the stockholders of 25 per cent of their present holdings will be $3,479,400. This will bring the capital stock of the company outstanding up to $17,397,000.

CANADIAN CAPITAL.—The par value of electrical concerns in Mexico, Cuba, Jamaica and South America promoted and owned principally by Canadian capitalists, is said to be over $107,700,000. The various enterprises are the Sao Paulo, the Mexican Light & Power Co., the Mexican Electric, the Rio Janeiro, the Havana Electric, the West India, the Havana Central and the Trinidad. The biggest money-maker of the group has been the Sao Paulo, which has found no difficulty in paying large dividends.

DETROIT HOME TELEPHONE.—St. Louis capitalists associated with the Commonwealth Trust Co. are interested in the new Detroit Home Telephone Co., recently chartered with a capital stock of $2,000,000 and an equal amount of bonds. This company will be one of the links in the chain of transcontinental independents. The promoters of the company are interested in the new United States Independent Telephone Company.

PACIFIC GAS & ELECTRIC.—The stockholders of the Pacific Gas & Electric Company, which has been formed to acquire the business and assets of the San Francisco Gas & Electric Company and the California Gas & Electric Corporation, will have a special meeting in San Francisco December 19, for the purpose of voting on a proposition to create a bonded indebtedness of $10,350,000.

KINGS COUNTY LIGHTING.—The New York State Gas & Electricity Commission has received application from the Kings County Electric Light & Power Company, of Brooklyn, for permission to increase its capital stock from $5,000,000 to $10,000,000, for improvement of plant. A hearing was set for Nov. 17 at New York.

NEW ENGLAND TELEPHONE STOCK.—A special meeting of the Southern New England Telephone Company will be held Nov. 1 at New Haven, Conn., to accept a legislative amendment to the charter which permits the company to issue $10,000,000 capital. The present capital stock is $5,000,000.

HARTFORD LIGHTING STOCK.—The Hartford Electric Light Company will increase its capital stock from $1,600,000 to $1,800,000. Stockholders are given the right to subscribe at par ($100) for one new share for every eight held. The stock is quoted at $250.

CHICAGO EDISON.—The Chicago Edison Company has sold electric power equal to 7,000 hp on long contract to the Chicago City Railway Company. During the next two years the Edison Company will expend $4,000,000 in improvements.

SALE OF MALDEN PROPERTY.—The Malden, Mass., Electric Company has acquired the control of the Malden & Melrose Gas Company by the purchase of 3,300 shares of the 4,050 shares outstanding at about $200 a share.

General News of the Week

The Telephone.

PINE BLUFF, ARK.—The Southwestern Telegraph & Telephone Company has another ordinance before the City Council for a franchise for underground conduits.

LITTLE ROCK, ARK.—An arrangement has been perfected between the Southwestern Telegraph & Telephone Company and the Reich Telephone Company for connections between this city and Center, Ridge, Springfield, Solgohatchia, Overcup and other places.

LEWISTON, IDAHO.—The Pacific States Telephone Company intends to expend $12,000 on its system here.

BOISE, IDAHO.—The Independent Telephone Company will install in its new exchange here a central energy switchboard with a capacity of 12,000 telephones. It will cost $20,000.

LEWISTON, IDAHO.—J. E. McGillivray has closed a contract with the Lewiston-Sweetwater Irrigation Company for the construction of about 16 miles of telephone line along the company's Sweetwater ditch.

DECATUR, ILL.—The Central Union Telephone Company is building a number of new toll lines out of Decatur, one to run to Champaign. The work will cost from $30,000 to $40,000.

QUINCY, ILL.—The Quincy Automatic Telephone Company has increased its capital stock from $15,000 to $1,000,000 and has changed its name to the Quincy Home Telephone Company.

MARION, IND.—O. L. Barger, of Converse, is canvassing this city to see if contracts can be secured for enough telephones to insure the starting of a new company.

LEITER'S FORD, IND.—The Leiter's Ford Telephone Company has incorporated with $2,000 capital stock. B. F. Overmeyer, J. B. Campbell and C. E. Anderson are directors.

VINCENNES, IND.—The Knox County Home Telephone Company has authorized the creation and issuance of $125,000 of preferred stock. The purpose is to improve and extend the system. W. H. Volmer is president. Some facts regarding the telephone situation here were given in last issue.

SOUTH BEND, IND.—The directors of the South Bend Home Telephone Company have declared a semi-annual dividend of 1 per cent on the stock. The South Bend Company is one of the most progressive and prosperous companies in the State.

LEBANON, IND.—The Converse Telephone Company, which for the past five years has been a sublicensee of the Central Union Telephone Company, has severed its connection with the Bell interests and now connects only with the independent systems.

COLUMBUS, IND.—The Citizens Telephone Company of this place has purchased and taken over the Hope Independent Telephone Company of Hope, the price being $28,000. No sooner was the Hope deal consummated than the Citizens Company began negotiating for some of the other independent telephone companies in the surrounding country. Since the Citizens Telephone Company is owned by the Indianapolis Telephone Company, which is closely allied to the New Long Distance Telephone Company, the systematic purchase of these small plants is significant.

GRAND MARAIS, MICH.—The Superior Telephone Company has decided to extend its line to connect with the Grand Marais life-saving station.

DETROIT, MICH.—Articles of incorporation of the Home Telephone Company, capital stock $10,000, have been filed. Among the incorporators are: Max Koehler and Samuel B. Jeffries, of St. Louis, and C. M. Burton and L. A. E. Weadock, of Detroit.

SALINE, MICH.—The Saline Telephone Company, which holds a license from the Michigan State Telephone Company for this village and surrounding territory, has just completed the work of cabling its exchange. An additional section of switchboard will be ordered in a month or two, and at the same time 3,000 feet of 25-pair cable will be added to the system.

SHELBY, MICH.—Shelby, Ferry and Elbridge farmers are preparing to run a telephone line to Shelby, which is to be a part of the system of the Oceana Farmers' Mutual Telephone Company. The Farmers' Mutual now has 14 miles of wire strung, 17 telephones in use, and is closing contracts for the purchase of toll lines to Shelby, Pentwater and Mears. The company has a contract with the Bell Company to furnish exchange service at Shelby, Hart and Pentwater.

WATERVILLE, MINN.—The Canno Valley Telephone Company has increased its capital to $60,000.

NORTH BRANCH, MINN.—The Northwestern Telephone Company has applied for a franchise here.

ALBERT LEA, MINN.—The majority of the Albert Lea Telephone Company's stock is to be sold to the Northwestern Telephone Company.

ST. JAMES, MINN.—The St. James Telephone Company has been formed with a capital of $25,000. Incorporated by C. E. Fuller and J. K. Sonneszn.

ST. PAUL, MINN.—The Northern Pacific Railway Company is constructing a long-distance telephone line from Fargo to St. Paul by the way of Brainerd.

STILLWATER, MINN.—A deed of transfer has been filed by which the Mutual Telegraph Company, a Wisconsin corporation, sells out its entire property to the Tri-State Telephone & Telephone Company.

MANKATO, MINN.—The Northwestern Telephone Exchange Company has begun to construct a farmers' telephone line from this city to Eagle Lake. Twenty or thirty farmers have subscribed for the service.

NEW ULM, MINN.—The capital stock of the New Ulm Rural Telephone Company has been increased from $50,000 to $100,000 and the company is now authorized to incur an indebtedness of $50,000, five times as much as it had at the start.

MOORHEAD, MINN.—The Northwestern Telephone Company has transferred its toll stations in the Red River Valley adjacent to Fargo to the Red River Telephone Company, which will hereafter operate them. The stations are at Sabin, Baker, Glyndon and Horace.

TOWNER, N. D.—The Western Telephone Company has been incorporated. Oliver Dalrymple is president; John Dalrymple, Casselton, secretary and treasurer; Wm. Dalrymple, Duluth, vice-president; Chas. C. Dalrymple, Tower City, and others. The stock is all owned by Oliver Dalrymple & Sons.

JERSEY CITY, N. J.—The New York & New Jersey Telephone Company will on November 1 reduce its message rate in this city from 10 cents to 5 cents.

PALERMO, N. Y.—The Palermo Telephone Company has been organized with a capital of $5,000, by S. E. Bowles, president, and W. W. Turner, clerk.

SARDINIA, N. Y.—The Erie Wyoming Telephone Company of Sardinia, Erie County, has been incorporated. The directors are: R. R. Allen and A. W. Phelps, of Chaffee, and H. R. Freeman, of Sardinia. The capital stock is $10,000.

ATTICA, N. Y.—A new corporation has been organized by the citizens of this town to be known as the Attica Home Telephone Company. George T. Loomis, Clarence H. Beane, W. A. Joiner, Elon P. Spink, Hugh Miller, Carlton D. Wing and Henry B. Flach are the directors. The capital stock of the company is $10,000.

MILAN, OHIO.—The Milan Telephone Company has been formed with a capital stock of $1,000. Incorporators: E. W. Swarthout, J. M. Spencer and G. W. Toole.

CLEVELAND, OHIO.—The earnings of the Cuyahoga Telephone Company for August were $50,528.34, a gain of $13,070.11 over the earnings of August last year. The surplus for the month was $8,051.47, a gain of $2,463.62, or about 45 per cent. The earnings for the first eight months of the year show a gain of $96,256.44 in the gross earnings, and the surplus for the eight months' period was $63,561.71, which was a gain of over 50 per cent.

CANTON, OHIO.—The Stark Telephone Company is to spend $173,000 in making improvements in this city and in Alliance. At present the Stark Company has 3,723 subscribers in Canton and 1,100 in Alliance. It is proposed to construct an extensive addition to the present switchboard, which will then accommodate 1,000 more subscribers in this city. A like improvement is to be made in the company's Alliance office. Sixty-eight thousand feet of cable are to be used in Canton and 2,600 feet in Alliance.

OKEENE, OKLA.—The Mutual Telephone Company has been formed with a capital of $10,000. The incorporators are H. Slemmer and P. D. McClung.

OREGON CITY, ORE.—Frank R. Andrews has applied for the right to build and maintain telephone wires and poles in the streets of Oregon City.

DRAIN, ORE.—The Drain Water Power, Light & Telephone Company has been incorporated by Ira Wimberly, Benton Mires, W. W. Kent, W. C. Edwards and Sam Jones.

DOYLESTOWN, PA.—The Keystone State Telegraph and Telephone Company has petitioned the Borough Council for a franchise for a telephone system in the Borough.

FORT LAWN, S. C.—A new telephone company has been organized at this place. Less Abernathy is president.

HURON, S. D.—Articles of incorporation have been filed for the State Independent Telephone Company at Huron with a capital of $1,000,000. The incorporators are G. G. S. Hutchinson and C. I. Crawford, of Huron; R. F. Pettigrew and George W. Burnside, of Sioux Falls; Andrew E. Lee, of Vermillion, S. D.; E. A. Bruce, of Yankton; E. C. Ward, of Geddes; E. H. Moulton, of Minneapolis, and J. Novotny, of Yankton. The plan is to combine the different independent companies of the State into one organization.

BEAUMONT, TEX.—The principal office of the Lone Star Telephone Company has been moved from San Antonio to Beaumont.

COMMERCE, TEX.—The Commerce Telephone Company has increased its capital stock from $5,000 to $10,000.

AUSTIN, TEX.—The Childress-Wellingston Telephone Company, of Childress, has been incorporated, with a capital stock of $5,000.

DALLAS, TEX.—The Texas Consolidated Long Distace Telephone Company, of Dallas, has increased its capital stock from $30,000 to $60,000.

LONE OAK, TEX.—The Citizens' Telephone Company has filed an amendment to its charter increasing its capital stock from $8,000 to $16,000.

DECATUR, TEX.—The Decatur Telephone Company is in the market for telephone cable, cable terminals, lightning arresters, etc. R. E. Moore is secretary.

SHERMAN, TEX.—The North Texas Telephone Company, of Sherman, is constructing a long-distance line from Sherman to Gainesville via Pottsboro and Woodbine.

DEL RIO, TEX.—The local telephone system and exchange has been purchased by T. H. Sharp and L. Rust, of San Angelo. They will make extensive improvements.

MILANO, TEX.—The H. R. F. Telephone Company will build a line from this place to other points. The company recently completed a line from Milano to Hanover.

OLDENBURG, TEX.—The La Grange & Waldrick Telephone Company has been incorporated with a capital of $1,000. The incorporators are: H. Amberg, Louis Voelkel, Charles France and others.

WEATHERFORD, TEX.—The Riddall Telephone Exchange, which has operated an independent system at Waxahachie for the past few years, has been purchased by J. R. Thomas and Charles Clark. The new owners are preparing to extend the system to outside points.

SAN ANTONIO, TEX.—Another development in the Commercial Telephone Company litigation has taken place here by the filing of a suit in the district court by H. M. Aubrey for $42,000 damages against F. C. Smith, president, and E. A. Glass, secretary of that company. Mr. Aubrey alleges that he owns 422 shares of stock in the company and that through acts of defendants the stock lost all of its value. The petition alleges that in order to wreck the property Smith in 1903 caused to be transferred to him 160 miles of the most profitable part of the lines of the company to satisfy a claim of his wife against the company.

CASTLEDALE, UTAH.—The Eastern Utah Telephone Company has purchased the Carbon and Emery County telephone line. It will build 80 miles of line in Carbon County.

WILLIAMSBURG, VA.—The Chesapeake Telephone & Telegraph Company, organized here in 1900, has passed into the hands of the Southern Bell Telephone Company. The price paid by the Southern Bell is said to be less than $8,000.

RICHMOND, VA.—The United Frederick and Clarke Telephone Company has been formed by J. H. Funkhouser, president, Clarke County; P. M. Funkhouser, secretary and treasurer, Frederick. Capital stock, maximum $1,000; minimum $200.

SEATTLE, WASH.—Articles of incorporation for the Seward Co-Operative Telephone Company have been filed. The capital stock is $25,000. The organizers of the company are H. C. Ewing and William M. Calhoun, of Calhoun; F. E. Brightman, A. J. Tennant, Richard E. Morris and C. D. Haskins.

WAUZEKA, WIS.—The Shanghi Ridge Telephone Company has been organized. A line will be built to Prairie du Chien. Wm. Gossell is president, and C. L. Smethrust secretary.

MILWAUKEE, WIS.—The Cream City Telephone and Telegraph Company has asked for a franchise in this city. The enterprise, it is said, is backed by a syndicate headed by W. D. Shroud, of St. Louis.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has announced a change in the schedule of telephone rentals to Milwaukee patrons. One of the principal reductions concerns the rates upon residence telephones. The nickel-in-the-slot machines now cost from $1.50 to $3 a month, and the company has planned a readjustment, permitting a rebate based upon the number of calls and a much better service at a cost of from $2 to $2.50 a month.

DAUPHIN, MAN.—The rate payers have voted in favor of installing a municipal telephone service.

NEEWPAWA, MAN.—The Council is sending out circulars with the idea of starting a movement for municipal telephone plants in all Manitoba towns. George Belton is interested.

WINNIPEG, MAN.—The municipalities of Manitoba have signed for presentation to the legislature various petitions asking that body to take over and operate the telephone systems in the province. It is stated that at Neepawa a public service at low rates has been instituted with financial success. An effort is being made by a number of Chicago business men to secure a franchise in Winnipeg to compete with the existing system. A report made shows that Winnipeg has a telephone for every 13 inhabitants, which it is claimed is the highest average for any city in the Dominon.

CHOLULA, MEX.—An extensive system of telephone lines has been built with this city as the center. These lines connect twenty-three towns with Cholula.

MONTEREY, MEX.—The records of the State Government of Nuevo Leon show that there are in this State 2,105 kilometers of telephone lines, with 985 exchanges, in operation. Twenty-five towns of the State have telephone connection with Monterey.

CHIHUAHUA, MEX.—The Chihuahua Telephone Company has obtained an extension of its franchise in the city and State of Chihuahua for a further period of 25 years. It is stated that the company will make extensive improvements and important extensions of its system.

CITY OF MEXICO, MEX.—The Mexican government has ordered the construction of about 1,953 kilometers of telegraph lines between the City of Mexico and Puebla. The wires will be placed upon iron posts, 3,000 of which will be required for the purpose. The work will be done under the direction of Engineer Camilo Gonzales, director general of Federal telegraphs.

KINGSTON, ONT.—A telephone line is to be constructed between Kingston, Ont., and Watertown, N. Y. At present telephone connection between these two places is obtained by way of Ogdensburg.

NORTH VANCOUVER, B. C.—The British Columbia Telephone Company has agreed to install a system here on condition that the lines of the company be exempt from taxation until 200 telephones are installed. The system will be working by Jan. 1, 1906. Address Supt. Kent, Vancouver.

Electric Light and Power.

HOT SPRINGS, ARK.—The Citizens Electric Light Company is about to be incorporated with a capital of $200,000.

VAN BUREN, ARK.—The Van Buren Electric Light & Power Company has been chartered with a capital of $25,000. John E. Powers is president; Henry L. Fitzhugh, vice-president, and Sidney A. Pernot, secretary and treasurer.

BAKERSFIELD, CAL.—The dam at the intake of the Power Development Company's tunnel, just below the Edison company's camp No. 1, in the Kern River canyon, has been completed and the entire flow of Kern River, consisting of nearly 300 feet, is now running through the power company's tunnel. The flow is more than sufficient for the needs of the company, but the excess is turned back to the river through the waste gate near the mouth of the tunnel.

EUREKA, CAL.—The Humboldt Transit Company has ordered an additional 250-kw railway generator from the Westinghouse Electric & Manufacturing Company. Two Union Iron Works engines, each capable of driving a 300-kw generator, have been purchased from the United Railroads of San Francisco, one of which will operate the new generator. The steam reserve station of the Humboldt Transit Company is being operated to a large percentage of its capacity. About $175,000 has been spent on the system during the past year.

HOLTVILLE, CAL.—It is stated that work on the power plant of the Holton Power Company will be rushed to completion. In a few weeks, the work of repairing the poles and placing them along the route to Calexico, Imperial and Brawley will be taken up. The transmission line will follow the Holton Interurban to El Centro, where it will diverge, one line going to Imperial and Brawley, and the other to Calexico. The route, after leaving El Centro, will follow the Southern Pacific right-of-way both north and south. If delay of material does not prevent, power will be turned on shortly after Jan. 1, 1906.

DENVER, COL.—It is probable that a power plant developing 15,000 horsepower, more than enough to supply the city of Denver for lights and the tramway company with power, will be built within 60 miles of this city in the near future. One site for such a plant is on the Platte River, using Lake Cheesman for a storage reservoir, and another site is at the junction of the North and South forks of the Platte River, which is only 29 miles from Denver. The cost of such a plant, complete for transmitting the power to Denver, will be about $1,500,000.

ESSEX, CONN.—The Essex Light & Power Company has broken ground for the new power house on Buck Lane, near the river front.

WASHINGTON, D. C.—Plans and specifications have been prepared for the construction of a central heating, lighting and power plant for all the buildings at the Soldiers' Home. Capt. John S. Sewell is superintendent of construction.

TALLAPOOSA, GA.—The citizens have voted to issue bonds for the construction of an electric light plant. E. A. Latimer is city clerk.

ROME, GA.—R. L. West, of Atlanta, is one of the promoters of a company which proposes to construct an electric power plant on Etowah River, between Rome and Cartersville, to furnish electricity for power and other purposes. The capital is $400,000.

NASHVILLE, ILL.—K. A. Steinhauser has purchased the Nashville electric light plant.

FREEBURG, ILL.—The contract for constructing a municipal electric light plant has been awarded to W. A. Fuller, of St. Louis, Mo., for $8,014.

GRAYVILLE, ILL.—The proposition to issue $10,000 to pay for the Grayville water works and electric light plant carried at the special election Oct. 10.

BREESE, ILL.—All bids opened on Oct. 9 by the Breese Water & Light Co. for a new lighting plant have been rejected, and new bids will be received Oct. 30. Further information can be obtained by addressing V. J. Kluthe, architect, St. Louis.

CHICAGO, ILL.—The Metropolitan Gas and Electric Company of Chicago has been incorporated with a capital stock of $12,000,000. The incorporators are Joseph C. Markley, of Chicago; George F. Goodnow, of Chicago, and Harry W. Davis, of Wilmington.

LOCKPORT, ILL.—The trustees of the Sanitary District of Chicago opened bids Oct. 11 for furnishing electrical apparatus and materials for the power house near Lockport, and for the transmission line along the right of way of the Sanitary District of Chicago. The Western Electric Company, it is stated, submitted the only bid on the entire work, at $300,000.

VALPARAISO, IND.—The Valparaiso Lighting Company will spend about $30,000 in improvements, but the company is doing its own work. The improvements include the changing of the system into 3-phase, 60-cycle.

CHARLES CITY, IA.—A deal has been consummated whereby the electric light company passes from the control of H. V. Fussell & Co. to F. O. Martin and A. L. Dodd of this city. The last two mentioned recently purchased the water power at Floyd, and will use the same to furnish power for the light plant at this city, transmitting the electricity some six miles. It is said the new company will also make extended improvements.

PAOLA, KAN.—The citizens have voted to issue $25,000 bonds for the construction of an electric light plant.

CALDWELL, KAN.—A committee has been appointed to consider the subject of electric light in this place. There is a strong sentiment in favor of municipal ownership and also a strong opposition to it.

GREENVILLE, ME.—The Greenville Light and Power Company is constructing a new and larger electric plant about three miles east of Greenville. Mr. Charles D. Shaw, president of the company, and Mr. William M. Shaw, a director in the same company, are the chief promoters of this new enterprise.

PEPPERELL, ME.—The Pepperell Manufacturing Company has just closed a contract with the York Light & Heat Company whereby the latter company

is to furnish electric power for lighting the mills and for other purposes. Both the Pepperell and Laconia divisions are to be lighted by electricity. Something like 6,000 incandescent lights will be required to do this.

DEXTER, ME.—The plant of the Dexter Electric Light Company has passed into the hands of N. Curtis Fletcher, of Boston, who owns several electric light plants in Maine, among them being the one in Eastport and several in the western part of the State. It is generally understood that the power will be increased by the installing of a new and more powerful engine and better service in general will be given.

CLINTON, MASS.—A resolution has been adopted by the Mayor and Board of Aldermen, authorizing the issue of $2,000 bonds for the purpose of extending the electric light and water works systems.

WELLESLEY, MASS.—A special town meeting will soon be called in Wellesley to again consider the question of erecting a municipal lighting plant, at an estimated cost of about $80,000.

WORCESTER, MASS.—The present board of directors of the Worcester Electric Light Company has been re-elected without change at the annual meeting of the stockholders. Following the election of the directors, ex-Mayor A. B. R. Sprague was re-elected president, with H. H. Fairbanks secretary and treasurer, and William H. Coughlin superintendent.

WEST BRANCH, MICH.—The Au Sable Power Company is buying all the land it can secure along the Au Sable River, expecting to put in a big dam and supply electric power.

ROYAL OAK, MICH.—The village council has granted a 5-year contract to the Peninsular Lighting Company, of Detroit, to furnish the village with lights at the rate of $67.50 for light per annum. The company will furnish 15 or more lights.

GRAND RAPIDS, MICH.—The Cadillac Water & Light Company has been purchased by Grand Rapids and Cadillac investors and reorganized with a capitalization of $200,000 and an authorized bond issue of $120,000. The bonds provide for the purchase and improvement of the property. The officers of the new company are: President, William H. Anderson; vice-president, Edward Fitzgerald, Grand Rapids; treasurer, William H. Anderson; secretary, N. V. Gerrish; manager, George Westover, Cadillac. The organization of this company was briefly referred to last week.

GRAND RAPIDS, MICH.—Articles of incorporation have been filed with the secretary of state at Augusta, Me., by the Michigan Hydro-Electric Company of Grand Rapids. The capitalization is fixed at $500,000 and the papers are signed by M. B. Wheeler for himself and C. J. Holmes and R. H. Opdyke as trustees. The incorporation is for the purpose of developing water power privileges upon the Manistee and White River and supplying the cities and communities in Western Michigan with power and light.

WYANDOTTE, MICH.—Wyandotte's electric lighting plant has reached its capacity, while the machinery itself has nearly outlived its usefulness. This plant has caused more trouble perhaps than any other municipal plant in a small city in America. It is estimated that the plant has cost Wyandotte $100,000. It will cost $20,000 to modernize the plant. For the first time in its history the electric lighting plant of Wyandotte is almost self-supporting. There is talk of giving up the plant and securing power from either the Edison Company or the Pennsylvania Salt Co. These companies, it is said, can furnish power for street and house lighting at a less cost.

MINNESOTA CITY, MINN.—The Minnesota Light & Power Company is contemplating the enlarging of its plant.

ANNANDALE, MINN.—The Council is considering the construction of a lighting plant.

SHUBUTA, MISS.—The Shubuta Light & Water Company has been incorporated, with a capital of $5,000, by H. Hutchins, A. Bond and others.

HELENA, MONT.—The Wisconsin Bridge & Iron Company, of Milwaukee, Wis., has secured the contract to construct a steel dam near Helena, for the Missouri River Power Company. The dam will be 630 ft. long, 70 ft. high and capable of developing 10,000 horse-power.

KANSAS CITY, MO.—W. K. Palmer has charge of the engineering work connected with the extensive water power development of the Standard Power & Construction Company on the north fork of Canadian River, Indian Territory. Complete surveys, estimates, report, etc., have made. It is proposed to utilize the exceptionally favorable power conditions of this stream and to transmit power electrically to points in the territory within a radius of 100 miles. A system of interurban railways is also projected in connection with the enterprise.

YORK, NEB.—There is a movement here among the citizens looking to the construction of a municipal electric light plant.

NEW BRUNSWICK, N. J.—The subject of a municipal electric light plant is under discussion here by the citizens.

JERSEY CITY, N. J.—The Ajax Light Company has been incorporated here with a capital of $1,000,000, by William B. F. Rogers, Charles F. Hickey and Addison C. Ormsbee.

PATERSON, N. J.—The directors of the Paterson Electric Light, Heat & Power Company have decided to refuse a franchise with the amendments that the aldermanic Committee on Ordinance has approved. The new company claims that it is absurd for the aldermen to pretend they want competition in lighting, and then, when a company offers to compete and actually guarantees a large reduction, impose onerous conditions which practically forbid the new concern embarking in the business.

SYRACUSE, N. Y.—Bids received Oct. 9 for lighting the streets and public building have been rejected.

GOSHEN, N. Y.—The Goshen Illuminating Company has been incorporated with a capital of $25,000 by Jas. Gamble and Wm. H. Dixon, of New York, and John B. Johnston, of Brooklyn.

LYONS, N. Y.—The directors of the Wayne County Electric Company have elected these officers: President, Dwight P. Chamberlain; vice-president, Charles A A. Lux; secretary, Benton S. Rude; treasurer, William H. Aikenhead.

MOORESVILLE, N. C.—The citizens have voted to construct a municipal electric light plant.

LENOIR, N. C.—The town of Lenoir, N. C., has just granted a 30-year exclusive franchise to E. C. Ivey and associates for an electric lighting and power plant. The company formed will at once begin the installation of a 60-kw single-phase lighting system, 60 cycles, 2,200 volts, for 21 arc lamps for five years.

FAYETTEVILLE, N. C.—The Allis-Chalmers Company, of Milwaukee, Wis., is stated to have secured the contract for overhauling and enlarging the municipal electric light plant for $7,250. The Westinghouse Electric & Manufacturing Company secured the contract for a 235-kw generator and 60 alternating arc lamps for $5,407.

SHAWNEE, OKLA. TER.—The Shawnee Light & Power Company's property has been sold to Charles A. Freuauff, of New York City. The company has been in the hands of a receiver for over a year.

UNION, ORE.—The Grand Ronde Electric Company has prepared plans for a substation in Union, and will expend about $20,000 in bringing power from Cove to Union.

PLAINS, PA.—J. Robertson Williams is interested in the construction of an electric light plant here.

BIRDSBORO, PA.—Plans are being prepared for the construction of a municipal electric light plant.

YORK, PA.—It is reported that the Conewingo Electric Power Company is about to construct a 30,000-horse-power plant to furnish light to York.

DANVILLE, PA.—Bids will be received until Oct. 27 by Dr. Levi I. Shoemaker, State Hospital for the Insane, at Danville, for the erection of a power house, electric generator plant, engines, boilers, motors, etc., and the wiring of administration building, wards and other buildings, grounds, etc. Plans and specifications may be obtained from Philip H. Johnson, architect, 1826 Land Title Building, Philadelphia.

YORK, PA.—The York Manufacturing Company is negotiating with the York Haven Water & Power Company for electric energy amounting to 500 horse-power. Incidentally 12 steam engines are to be sold by the manufacturing company. The engines range from 40 to 200 horse-power. In putting in the new power the company will not dispense with its large steam engine, generator and battery of five boilers, but will retain them for service as an auxiliary or in case of accident.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company is enlarging its boiler house to provide for the addition of two batteries of boilers. It will also install two steam turbines. The company is completing conduit work on the east side of the city which represents an outlay of $200,000.

RICHFIELD, UTAH.—The Richfield Light & Power Company intends extending a line to Glenwood and furnishing that town with light.

MORETOWN, VT.—H. O. Ward, of Moretown, will build an electric plant at the old mill site on the Moretown road.

BURLINGTON, VT.—The Board of Aldermen has appropriated $5,000 for the extension of the municipal electric light plant.

FORT MYER, VA.—Malcolm W. Hill Company, of Washington, D. C., has secured the contract for constructing an addition to the electric light system at the Signal Corps Post, Fort Myer, for $2,694.

TENINO, WASH.—S. W. Fenton has applied to the County Commissioners at Olympia for an electric light and water franchise for Tenino.

WENATCHEE, WASH.—The Council is considering the question of purchasing the electric light plant of the Wenatchee Electric Power Company for $80,000.

PROSSER, WASH.—The fight between the city administration and the Prosser Falls Land & Power Company has been settled by the Council granting the company an electric light franchise. At the same meeting the Council declined to pass a franchise giving the Prosser Electric Company the exclusive right to light the streets for a term of 20 years.

WHEELING, W. VA.—Wheeling Electrical Company and the Consumers' Electric Company have been consolidated under the name of the Light Companies of Wheeling. It is the intention to make improvements to the plants and to carry out the plans, a mortgage of $500,000 has been placed upon the property of the two companies.

FOND DU LAC, WIS.—The Independent Heat, Light & Power Company has petitioned for a franchise in this city.

WESTFIELD, WIS.—Articles of incorporation have been filed by the Westfield Milling & Electric Light Company, with a capital of $30,000. Incorporators: W. H. Moss, Westfield; Clark Older, Portage, and others.

MILWAUKEE, WIS.—The finance committee of the Common Council has decided to recommend for passage a resolution instructing the Board of Public Works to receive bids for a site for a municipal lighting plant. The committee also favorably considered the resolution to employ an engineer to draft plans for the proposed plant.

LARAMIE, WYO.—The new electric light company, represented by W. C. Stern, of Littleton, Col., has purchased the plant of the old company, and intends making improvements, including the installation of an alternating system.

BRANDON, MAN.—A syndicate is being formed to develop the power on the Assiniboine River here. Mayor Fleming can give further information.

CHATHAM, N. B.—Bids will probably be called for about May or June, 1906, for the construction of a municipal lighting plant. The probable cost will be $35,000. P. J. McIntyre is town clerk.

The Electric Railway.

AVALON, CAL.—The Banning Company has applied to the supervisors for a 30-year franchise for a double-track street railway, at Avalon, Santa Catalina Island.

SAN DIEGO, CAL.—The Bartlett Estate Company has been succeeded by the South Park & Eastside Railroad Company, which will develop the local traction plans.

CHICO, CAL.—Sealed bids will be received by the City Council until Nov. 1 for a franchise to construct and operate a street railway for a term of 50 years along certain streets of Chico, as applied for by David S. Edwards. C. E. Steinogul is the city clerk.

HARTFORD, CONN.—Articles of incorporation have been filed at the office of the Secretary of State by the Trolley Express Company, of New Haven, the incorporators being Charles S. Mellen, E. G. Buckland and Calvert Townley. The object of the company is the carrying of merchandise over various electric railway lines. The capitalization is $100,000. All the incorporators are officials of the New York, New Haven & Hartford Railroad Company and the Consolidated Street Railway Company, the holding company of the New York, New Haven & Hartford Company's electric railway.

CHICAGO, ILL.—W. S. Reed, promoter of the Chicago Southern Traction Company is making extensive plans for the improvement of the Chicago Electric Traction lines in Chicago, which he recently purchased.

AVA, ILL.—St. Louis capitalists have organized a company to construct an electric railway from Carbondale to East St. Louis. It is proposed to extend the Southern Illinois Coal Belt and Electric Railway from Herman to Carbondale and make this new road a connecting line to St. Louis.

MONMOUTH, ILL.—The Rock Island & Southern Railway has purchased the franchises of the Western Illinois Traction Company in Monmouth and from Monmouth to Galesburg. The company is now building between Monmouth and Galesburg on the old Western Illinois Traction Company's route. The secretary of the company is Wiley Stewart of Monmouth.

EVANSVILLE, IND.—The Evansville & Mt. Vernon Electric Railway has filed a mortgage of all its property to the American Trust & Savings Company, to secure the payment of a mortgage for $350,000.

GASS CITY, IND.—The Marion, Hartford & Eastern Railway Company has filed articles of incorporation with the Secretary of State. The capital stock is $25,000. J. L. Thompson, R. A. Brashear, W. B. Dodds and F. R. Chandler are the directors.

LOGANSPORT, IND.—The circuit court has granted the petition of the Fort Wayne & Wabash Valley Traction Company to condemn the tow-path of the old canal in Cass and Carroll counties for a right-of-way for a trolley line. The consideration is $25,000, to be paid to the owners of the old canal.

KOKOMO, IND.—The Kokomo Railway & Light Company, capitalized at $80,000, and the Kokomo, Marion & Western Traction Company, capitalized at $1,000,000, have consolidated under the name of the latter company. This action unites all lines of street and interurban railways and electric light, heat and power plants constructed and in the course of construction, or authorized to be constructed by the two companies.

MARION, IND.—A contract has been let to the American Engineering Company, of Indianapolis, to finance and construct a traction line from Huntington to this city and thence to Indianapolis. The capital stock of the company has been increased to $50,000. The road will be known as the Indianapolis, Huntington, Columbia City & Northwestern Traction Company, and the main office will be in Indianapolis. N. E. Weist, jr., is general manager.

INDIANAPOLIS, IND.—The final step looking to the ultimate merger of the interurban railways in Indiana was taken Oct. 17, by the election of Hugh J. McGowan, president of the Indianapolis & Northwestern and of the Indianapolis & Western Traction companies. The following companies are included in the consolidation: Indianapolis & Northwestern, Fort Wayne & Wabash Valley, Fort Wayne, Van Vert & Lima, Indianapolis & Martinsville, Indianapolis & Eastern, Richmond Street & Interurban, Indianapolis & Western, Fort Wayne, Bluffton & Marion and Muncie & Portland.

MASON CITY, IA.—The Mason City & Clear Lake Railway has purchased several lots on Main and Drummond Streets upon which will be erected the car barns and the power plant.

DUBUQUE, IA.—The Dubuque & Wisconsin Railway Company has completed its organization in Iowa. The capital stock of the company is placed at $151,501. The directors are J. M. McFadden, A. W. Tredway, F. J. Peikenbrock, H. H. Blish, J. E. Hedley, C. A. Noyes and Maurice Connolly.

PARSONS, KAN.—Parker Wineman, of Chicago, has been granted a franchise by the Council for the construction of an electric railway here.

PADUCAH, KY.—Messrs. Stone & Webster have purchased the street railways, electric light and gas companies of Paducah, Ky., and have combined them under one management under the name of the Paducah Traction & Light Company, incorporated under New Jersey laws. This company has an authorized capital of $2,000,000.

PATERSON, N. J.—President William Barbour, on behalf of the directors of the New York & North Jersey Rapid Transit Company, has accepted the franchise granted by the Board of Aldermen to the company. The company will now proceed to purchase private rights of way from this city to the Hudson River. Part of the road will be elevated, and it is the intention of the directors of the company to make it possible to reach New York in twenty minutes.

ONEIDA, N. Y.—The directors of the Rome & Oneida Electric Railway Company have elected officers as follows: President, C. C. Goodwin, New York; vice-president, De Witt C. Hancock, Oneida; secretary, Charles Leonori, New York; treasurer, Dr. J. L. Hill, New York.

ENID, O. T.—Enid will grant a fifty-year street railway franchise to responsible parties who will guarantee to build a system of six to eight miles in the city within a reasonable time. A special census of the city, taken last spring, indicated a population of 12,000. Any information desired regarding this matter or the volume of business of Enid will be furnished by the Mayor, Secretary of the Commercial Club or editor of the *Enid Daily News*.

SEATTLE, WASH.—Arrangements have been made for financing the Seattle, Everett & Skagit Railway Company, which plans to build an electric railway from Seattle to Everett at this time and later to extend the road so as to complete it between Seattle and Bellingham Bay. The Silver Lake Syndicate, an English concern with offices at Salisbury House, London, has become interested in the project, and through it a mortgage has been placed with the Colonial Trust Company of New York for $1,500,000. The contract for building the road has been placed with L. M. Rice, of Seattle. The officers are: President, W. H. Goldson; vice-president, W. Lair Hill; secretary, Edwin S. Gill; treasurer, Otto Stendahl.

FOND DU LAC, WIS.—The Wisconsin Rapid Transit Company is endeavoring to finance a project which it has under way for the construction of an electric railway between Fond du Lac, Eden, Campbellsport, Kewaskum, Barton, West Bend, Jackson, Cederburg, Milwaukee, Port Washington, etc. The company owns about 24 miles of roadway and has surveyed 208 miles of the line.

EAU CLAIRE, WIS.—A local syndicate, composed of O. H. Ingraham, C. Rundy, Roy P. Wilcox, John T. Owen, Byron A. Buffington and George B. Wheeler, has purchased from Arthur E. Appleyard control of the Chippewa Valley Electric Railway. New officers have been elected as follows: President, O. H. Ingraham; vice-president, John T. Owen; treasurer, B. A. Buffington; secretary and manager, George B. Wheeler.

NEW WESTMINSTER, B. C.—W. H. Moore is promoting a company to build an electric railway from Spencer Bridge to Thompson River, a distance of 100 miles.

LAS VEGAS, N. M.—The Las Vegas Railway & Power Company, a new corporation, will succeed the Las Vegas & Hot Springs Electric Railway, Light & Power Company as soon as the affairs of the latter company can be wound up. The company is now erecting a new power house at 12th Street and San Francisco Avenue. In addition to car service equipment, the company is also installing a complete alternating current plant for lighting service.

ST. CATHERINES, ONT.—The sale of the St. Catherines, Pelham & Welland Electric Railway Company's charter to build a line from this city to Dunnville and another to Welland has practically been closed with a syndicate from Toronto capitalists.

New Industrial Companies.

THE ELECTRIC MOTOR VENTILATOR COMPANY has been incorporated at Wilmington, Del., with a capital of $250,000.

THE ELECTRIC CAR COOLING COMPANY has been formed at Ossining, N. Y. Capital, $68,000. Directors: J. P. Foure, P. M. Pierson and A. M. Swiggar, Ossining.

THE UNIVERSAL POWER AND PROMOTION COMPANY, of Wilmington, Del., has been formed to furnish all kinds of power and promote enterprises; capital, $100,000.

THE ACME ELECTRIC COMPANY, of Nashville, Tenn., has been incorporated, with a capital of $5,000. The incorporators are Frank S. Mead, R. K. Gibson and H. J. Henry.

THE CONNECTICUT DEVELOPMENT COMPANY has been incorporated at Jersey City, N. J., with a capital of $100,000. The incorporators are George H. Benjamin, C. Douglas Green and Frank O'Connor.

THE MONTAUK ENGINEERING COMPANY has been formed in New York with a capital of $10,000. The directors are J. A. Anderson and R. E. Jordan of New York, and F. L. Haggerty of Brooklyn.

THE HINKSON ELECTRIC LIQUID PURIFYING COMPANY, of Pittsburg, Pa., has been incorporated in Delaware. The company will manufacture electric and mechanical filters. Its capital stock is $100,000.

THE EGAN ELECTRICAL & TELEPHONE MANUFACTURING COMPANY, of Kenosha, Wis., has been formed with $100,000 capital, by Julius S. Carr, of Chicago, and C. R. Ryan. The former is president, the latter general manager.

THE HALL TELEPHONE MANUFACTURING COMPANY, of New York, has been incorporated, with a capital of $50,000. Directors, R. B. Constantine, South Orange, N. J.; E. J. Hall, Brooklyn, and A. B. Cox, Jr., New York.

THE ROYAL BATTERY COMPANY, of New York, has been formed to manufacture storage and dry batteries; capital, $5,000. Directors: Emil Grossman, Carl Kaufmann, Alfred Lowenstein, Julius Silverman and Hugo Gernsback, New York.

THE CITY OF WINNIPEG POWER ASSOCIATION has been incorporated at Winnipeg, Manitoba, with a capital of $100,000 to develop electric power on a large scale. Among the promoters are J. H. Ashdown, John Arbuthnot, R. T. Riley, Alex. Macdonald and D. W. Bole.

THE PRE-PAYMENT ELECTRIC METER COMPANY has been incorporated at Petersborough, Ont., to manufacture electric meters, motors, transformers ,and other electrical apparatus. Capital, $100,000. The directors are: William Hamilton, J. H. Larmouth, J. H. McClellan, Alfred Parker, all of Peterborough, Ont.

Legal.

VOLUNTARY DISSOLUTION.—The New England National Automatic Fire Alarm Company, of New York, through John P. Faure, Thomas A. Watson, George D. Boschen and others, directors, has applied to the Supreme Court for voluntary dissolution, and Justice Stover has appointed Ashbel P. Fitch referee in the matter. The company was incorporated in 1902, with a capital stack of $300,000. The assets consist of office fixtures, patent rights, and $246 in bank. The liabilities amount to $915.

APPLICATION FOR RECEIVER.—Vice-Chancellor Stevenson, at Trenton, N. J., has made an order requiring the Lambert Schmidt Telephone Manufacturing Company, of Weehawken, to show cause why a receiver should not be appointed for the company on the ground that it is insolvent and has not sufficient funds to continue its business. The complainant is J. Alaric L. Moller, a stockholder. The company was incorporated September 4, 1900, for the manufacture of telephone supplies. Later its capital stock was increased to $100,000.

Obituary.

MR. ALBERT GALLATIN.—The bearer of this distinguished name died suddenly on October 14, at his residence in San Francisco. He was eating dinner, when, without warning, his arms fell to his sides and his head dropped forward. His life was extinct almost immediately. The physician who was summoned said that apoplexy was the cause. Mr. Gallatin went to California in 1859, and entered the hardware store of Huntington, Hopkins & Co., at Sacramento, as a porter. After nine years of service he was taken into the firm and given the management of the business; Hopkins and Huntington having become interested in railroad building in the meantime, Mr. Gallatin sold the first shovel that was used in the construction of the Central Pacific. From this beginning he became one of the best-known capitalists of California. It was through his backing and personal energy that the scheme for the Folsom Power Company for supplying electric power for Sacramento was put through. This was the first utilization of water power for the generation of electricity for long-distance transmission on the Coast. For many years he was vice-president and manager of the Sacramento Electric, Gas and Railway Company. Like the original bearer of his name, one of the great founders of the American Republic, Mr. Gallatin was born in Switzerland.

Personal.

PHILIP P. BARTON.

MR. PHILIP P. BARTON has been appointed general manager of the business and operations of the Niagara Falls Power Company, and the Canadian Niagara Power Company. This appointment also includes that of general manager of the Niagara Junction Railway Company, and of the Niagara Development Company. Mr. Barton graduated from Cornell University in 1886 with the degree of Ph.B. After two years of post-graduate work in electrical engineering, he received from the same institution, in 1888, the degree of M.S. His professional career was begun in the electrical department of the Cambria Iron Company at Johnstown, Pa. After several months of practical experience there and with the Allegheny County Light Company, of Pittsburg, Pa., he entered the engineering force of the Westinghouse Electric & Manufacturing Company. For some years he was engaged in installing electric lighting and power plants in various parts of the country, mainly in the South and the West. In 1892, he entered the service of the Brush Electric Sompany, of Cleveland, O., in charge of engineering and sales at its Pittsburg office. After the closing of that office in February, 1898, he was connected for some months with the Pittsburg office of the General Electric Company. In September, 1898, he became assistant superintendent of the Niagara Falls Power Company at Niagara Falls, and two years later was made superintendent of the Niagara Falls Power Company at Niagara Falls, and two years later was made superintendent of the operating department of the same company. In July, 1905, he was appointed superintendent of the operation of the Niagara Falls Power Company and of the Canadian Niagara Power Company, which positions he has held until his present appointment. Mr. Barton is an active member of the American Institute of Electrical Engineers.

MR. W. W. PRATT has assumed the position of manager of the National Power Controller Company of Boston. The company has opened offices on Hartford Street, Boston. It manufactures the electrical apparatus of which Geo. W. Peirce is the patentee.

MR. C. N. KALTWASSER, of New York, has been appointed assistant to A. V. Wainwright, superintendent of the Norwalk district of the Connecticut Railway & Lighting Company's properties. Mr. Kaltwasser is a mechanical engineer, being a graduate of Steven's Institute.

MR. W. H. PATCHELL, engineer in chief to the Charing Cross & City Electric Co. and the Charing Cross & Strand Electricity Supply Corporation, is now visiting this country for the first time, and studying American central station development and practice. He is making a tour of inspection in New York, Boston and other cities. With him is Mr. W. F. Fladgate, chairman of the board of directors.

MR. DE LANCEY RANKINE has been made treasurer of the Niagara Power Company, and Mr. P. P. Barton, as noted above, general manager in full charge of the business interests of the company at Niagara Falls. Mr. Rankine is a brother of the late Mr. W. B. Rankine, and has already been connected with the corporation for some time.

NEW YORK ELECTRICAL SOCIETY.—The following named gentlemen were elected members of the New York Electrical Society at its meeting on October 23: Graham Smith, Paul S. Dieguardi, Walter R. Boyd, Henry Floy, W. Brewster Hall, M. C. Turner, Arthur Rice and H. M. Watson, all of New York City; J. MacDonald Smith, Ampere, N. J., and H. D. Bauer, Mt. Vernon, N. Y.

MR. HUGH T. COOPER, engineer of the Electrical Development Company, Toronto, has been retained by the McCall's Ferry Power Co. as manager of construction of its hydraulic works at McCall's Ferry. Mr. Cooper has associated with him Mr. Beverly R. Value, resident engineer of the Electrical Development Company's work at Niagara, who will be engineer in charge of the work.

MR. W. S. NEWPORT, who was formerly connected with the Northwestern Electric Equipment Company, of St. Paul, Minn., has entered the electrical and automobile supply trade for himself as a manufacturers' agent, and has an office at 519 Pioneer Press Building, St. Paul, Minn. Manufacturers who are not already represented in that territory are invited to correspond with him in regard to handling their goods.

MR. CHAS. W. LAWRIE, C. E., for several years general superintendent of the Ball Engine Company, of Erie, Pa., and consulting engineer for some of the most important high-speed engine builders in the United States, has accepted the position of general superintendent of the Reeves Engine Company, of Trenton, N. J. With these builders of the Reeves high-speed engine he will assume his new duties on November 1.

MR. F. C. BATES, well known as an officer of the New York Electrical Society, an energetic member of the American Institute of Electrical Engineers, and as a representative of the General Electric Company in New York City, was married on October 19, in Brooklyn, N. Y., to Miss Augusta Engenia Lazelle Hinrichs, daughter of Mr. and Mrs. F. W. Hinrichs of that city. The happy pair are now on their honeymoon.

MR. T. K. WELLS.—The Manila Electric Railway & Lighting Company, of Manila, P. I., which is controlled and operated by J. G. White & Company, of New York, has secured the service of Mr. T. K. Wells as superintendent of transportation. He has had a wide experience in railroad work, having been with the Wabash Railroad and the St. Louis, Iron Mountain & Southern Railroad for 14 years, and with the Syracuse Rapid Transit Company for eight years.

MR. W. JAC MARLAND, recently general agent of the Edison Illuminating Company, of Brooklyn, N. Y., has gone to Chicago to assist Mr. P. B. Yates, sales agents for the Gould Storage Battery Company, in the Western Territory. The sales of this well-known type of storage battery have increased to such an extent as to demand an enlargement of selling forces. Mr. Marland has had much experience throughout this territory and is very well known and liked.

MR. C. J. GLIDDEN.—Mr. Charles J. Glidden, the telephonist and automobilist, who has sailed this week for Europe on the steamer *Kronprinz Wilhelm* to resume his touring around the world in an automobile, related some of his experiences in former trips to the members of the Automobile Club of America, Fifth Avenue and 58th Street, Oct. 23. His talk was illustrated with over 200 views of automobiling and native scenes in Java, the Fiji Islands, Hawaii, New Zealand and Australia, most of which Mr. Glidden took himself.

MR. W. H. BEATTYS, JR., who has been acting as Chicago representative of the Cutler Hammer Manufacturing Company for the past three years, has accepted a position with the National Electric Company, of Milwaukee, and will be located in the Chicago office, where he will assist Mr. Chas. G. Burton, manager of electrical sales, in looking after the interests of the company in this department. Mr. Beattys is a graduate in electrical engineering of Armour Institute of Technology, class of 1899. After graduation, he spent two years with the Chicago Edison Company, and two years with Sargent & Lundy.

MR. HARRY H. HORNSBY, who succeeds Mr. Alexander Henderson as sales manager of the conduit department of the Sprague Electric Company, New York, has had many years experience in the electrical business both in the East and West. While chief inspector of the Department of Electricity in the city of Chicago, he did much to improve the standard of electrical protection. He resigned the position of chief inspector to become sales engineer of the conduit department of the Sprague Electric Company, which position he has held until his present advancement. Mr. Hornsby's extensive experience has qualified him to an unusual extent for his new positon. He has recently passed through a severe illness, and his many friends will be pleased to know that he is rapidly recovering his usual good health.

MR. C. C. COLLINS.—Mr. Curtis C. Collins, at one time connected with the General Electric Company in Lynn and Schenectady, has been appointed assistant general superintendent of the Columbus (O.) Railway and Freight Company. In its account of the appointment a Columbus paper has the following: "The new assistant general superintendent is not by any means a stranger in Columbus. He is a son of former Mayor George G. Collins. He graduated from the Ohio State University in 1895 as an electrical engineer. After six months' practical work he entered the employ of the General Electric Company and took the experts' course. He was in Dr. Steinmetz's office and in other departments He went to Baltimore as commercial engineer for Maryland, Virginia and North Carolina and then left the General Electric Company to take charge of the S. A. Luz Electrica in San Juan, Porto Rico. This

company operated a light and power plant and did an electrical contracting business. Mr. Collins reconstructed the plant and quadrupled its capacity bringing it up to the highest modern efficiency. He was appointed electrical and mechanical engineer for the city of Aucibo and built its three-phase water power transmission plant. The city of Humacao retained him as its consulting engineer and he assisted the towns of Barrio Nuevo, Mayaguiz, Guyama and Caguas in establishing plants. Mr. Collins returned to the United States because he did not wish to lose touch with things here and desired room to expand."

Trade Publications.

STEAM ENGINES.—The Ball Engine Co., Erie, Pa., has recently issued an illustrated booklet describing some new designs of engines of both the simple and compound types.

STORAGE BATTERIES FOR RAILWAY SIGNAL SERVICE. — The Westinghouse Machine Company, East Pittsburg, Pa., has issued an illustrated booklet devoted to storage batteries for railway signal service.

STEAM SHOVELS.—Bulletin No. 1402 of the Allis-Chalmers Company, Milwaukee, Wis., gives interesting information concerning the construction and operation of steam shovels. These machines are particularly well adapted for making excavations of all characters, and have met with marked favor for work on railways and the foundation of power houses.

ENCLOSED SWITCHES.—Circular No. 1121 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., is devoted to the type G combination fuse and switch. This switch has been designed to meet the demand for a strong and durable switch capable of withstanding severe service in the hands of unskilled labor, and protected from mechanical injury.

SECTIONAL PIPE COVERING.—A leaflet recently received from the H. W. Johns-Manville Co., 100 William St., New York, is devoted to safety blow-off sectional covering. This covering has been designed to eliminate the trouble caused by the undue expansion and contraction resulting from sudden change of temperature when the fire door is opened for coaling.

MOTOR SPEED-CONTROLLERS.—The Ward Leonard Electric Company, Bronxville, N. Y., has just issued catalogue No. 19055, covering motor speed-controllers for machine and similar duties. These motor speed-controllers have the same ampere capacity throughout and are equipped with independent, interlocking, overload circuit-breakers and no-voltage release, or with plain no-voltage release, or without any automatic features.

ELECTRIC SIGNS.—The American Electric Sign Company, 41 West Van Buren Street, Chicago, Ill., has recently issued some attractive circulars dealing with flasher electric signs. These signs are built to resemble a picture frame. At the rear of the electric lamp is placed a mirror-effect background, while in front of the lamp is placed a slide which forms the slide proper. A single sign equipment can be supplied with any number of slides, since the slides are interchangeable. The flasher is of the thermo-rheostat type.

CAR HEATING.—The Gold Car Heating and Lighting Company, 17 Battery Place, New York, has just issued an elaborate catalogue dealing with car heating devices. The catalogue contains 123 pages, 9 x 12 in. in size, and is well illustrated throughout. The extent to which these devices have been adopted can be learned from the fact that nearly 40,000 cars and locomotives have been equipped with steam heaters, and that more than 200,000 electric heaters have been sold. The catalogue contains an imposing list of prominent patrons and a liberal number of letters of approbation.

NATURAL VENTILATION.—The National Ventilating Company, 1 Madison Ave., New York, has issued a booklet entitled "The Most Essential Element of Life," dealing with ventilation. The company announces that it has in press a sumptuously illustrated treatise on "Natural Ventilation," which embodies the latest and most authoritative ideas upon the subject. Although the book will be too costly for promiscuous distribution, the company expresses its desire to place it in the hands of all who wish to know the best methods for the ventilation of offices and homes, without draught, dust, smoke, etc.

HYDRAULIC PUMPS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued bulletin No. 1607, describing a high-duty horizontal, double-acting, crank and fly-wheel, plunger pump driven by a cross-compound Reynolds-Corliss engine. Bulletin No. 1608 of the same company deals with motor-driven single-stage centrifugal pumps. The single-stage pumps have a runner of the "enclosed" type mounted on a steel shaft to which it is carefully keyed. The casing is of cast iron of the snail-shell type, and is fitted with machine covers of such size that the runner may readily be removed. The pumps are of the double-suction type, and hence the necessity of thrust bearings are eliminated.

INTER-POLE MOTORS.—Circular No. 16 of the Electro-Dynamic Company, Bayonne, N. J., treats of the constructional features and operating characteristics of the "Inter-pole" variable-speed motors. Circular No. 17 of the same company deals with the driving of machines by individual motors, and outlines the special advantages of the inter-pole motor for this class of work. In order to furnish information which will allow any one to estimate approximately the power required for operating any particular tool, the company has reprinted as circular No. 16 a table which appeared in the ELECTRICAL WORLD AND ENGINEER of May 27, 1905, showing the power ratings of electric motors which have been applied and actually operated on various machine tools.

"INSULATION BOOK."—Supplement No. 1, just issued by the Locke Insulator Mfg. Company, Victor, N. Y., to its insulator book, is a booklet of 34 pages, very attractively prepared and printed, and is designed to be slipped into the envelope provided at the back of the "Insulator Book" for the reception of supplementary publications. This supplement describes and illustrates a number of new insulators, many of which are intended to replace types illustrated in the regular catalogue, and to facilitate making these corrections readily, gummed labels are furnished to be attached to the proper pages of the "Insulator Book." A description of the testing and laboratory department, recently completed, is included in the supplement, as well as a description of the new style of shipping crate which the Locke Company has originated, and by means of which the largest types of insulators can be securely shipped already cemented together, as this can in many cases, be done to better advantage at the factory than in the field.

News of the Trade.

WIRING CONTRACT.—The contract for wiring the new Baltimore & Ohio Building, Baltimore, Md., was secured last week by Harry Alexander. Habirshaw Red Core wire will be used throughout.

H. A. CLARK COMPANY, Inc., is the style under which the American Equipment Company will hereafter conduct its business from Nov. 1, with officers at No. 17 State Street, New York City. Mr. H. A. Clark is president.

THE MENOMINEE ELECTRICAL MANUFACTURING COMPANY, Menominee, Mich., will begin the erection of a plant this fall. The site purchased for the plant is 353x120 feet. A large building with several wings will be erected to provide for the expected expansion of the business of the company.

O. S. WHITLOCK & CO., West Orange, N. J., manufacturers and importers of jewels for electrical and scientific instruments, have recently increased their facilites to care for the growth of their business. One of the causes of this recent growth is attributed to the prompt manner in which all orders are filled and the great care taken by the firm with its product.

BUSINESS ECONOMY.—Mr. Harold A. Wright, "consulting business economist," of 141 Broadway, New York City, makes a specialty of the study of the business problems of his clients, and can aid in the preparation of an accounting system, a factory cost system, a filing system, or any other feature whose adoption will add to economy, efficiency, security and profit for his clients.

NEW YORK ELECTRICAL EXHIBITION.—We are advised by the management of the proposed electrical exhibition to be held in Madison Square Garden, next December, that among the new exhibitors enrolled are the Gold Car Heating & Lighting Company, the Gray Telautograph Company, the Natural Food Company, of Niagara Falls, and the National Carbon Company. The apparatus and appliances of these concerns embrace many features of interest.

A VARIETY OF PRODUCT.—The various stations and shops of the Philadelphia Rapid Transit Company furnish an interesting exhibit of the variety in products manufactured by the B. F. Sturtevant Company, of Boston, Mass., for the equipment of plants of this class. In the various sub-stations are no less than ten steel plate fans especially designed for cooling transformers. In one of its shops is a complete heating and ventilating system consisting of fan, heater and distributing pipe. In another is a forge shop equipment, together with an exhauster for removing smoke, while a large cupola furnace is supplied with a Sturtevant pressure blower.

LONG-ARM IN LONDON.—It is announced from London that the "Long-Arm" System Company of Cleveland, O., has been awarded a gold medal for its Earl's Court exhibit of "Long-Arm" electrically operated power doors for ships. This was one of the few displays of American devices in the Naval, Shipping and Fisheries exhibit. The exhibit of this system, by which bulkhead doors are closed from a central station in time of an emergency, has attracted the favorable attention of many European naval experts. Foreign admiralties are investigating it with a view to its adoption, following the example of the American Navy, which has installed the "Long-Arm" system on 32 of our ships. The development of automatic bulkhead doors has been effected wholly within the United States Navy. Mr. Francis T. Bowles, formerly chief constructor, first conceived the idea of an electrical apparatus for operating these doors. Another graduate of the Naval Academy, W. B. Cowles, perfected Admiral Bowles's idea into the practical system now in use.

BAKER & COMPANY, INC., refiners and manufacturers of platinum, gold and silver, Newark, N. J., and New York City, have been awarded a gold medal for the excellence and variety of their exhibit at the Lewis & Clark Centennial Exposition, just closed at Portland, Ore. Being the first exhibit of its character on the Pacific Coast, and located in the Mines & Metallurgy Building under government supervision, it attracted the special attention of a large number of visiting miners and metallurgists, who, in recent years, have been devoting greater care to the recovery of the platinum known to exist in the alluvial deposits along the Pacific Coast. Baker & Company's exhibit was comprehensive in its character, including numerous samples of crude platinum ore, the salts and solutions of the metal, and various forms of platinum ware, such as are used daily in the arts and industries. A more extensive exhibit, which they displayed at the Louisiana Purchase Exposition in 1904 was awarded the grand prize.

THE AUTOMOBILE SHOW.—For the sixth annual automobile exhibition of the Automobile Club of America, to be held in the new 69th Regiment Armory, New York City, in January next, over 45,000 square feet of space has been applied for. Those intending to exhibit at what it is announced will be the most artistic industrial show ever seen in this country, should bear in mind that all application for space, in order to receive consideration in the first allotment, must be made to Secretary S. M. Butler, 753 Fifth Avenue, New York City, not later than Oct. 28. Since one-third of the net profits go to the exhibitors in proportion to the amount of rental paid by each, it is assured that the outlay to those displaying motor-driven vehicles and accessories will be appreciably reduced. The magnificent drill hall, with its high steel arched roof, will permit of an imposing array of vehicles; the roomy galleries will supply exceptional opportunities for the parts and accessories concerns, while down in the basement, which will be well lighted and inviting, the heavy vehicles will find an attractive setting. Being of fireproof construction throughout, the building will offer no danger whatever from fire, and insurance rates will be exceedingly moderate. Smoking will be permitted only in the smoking room. A convenience will exist in the bureau of information that will be in operation three days previous to the opening of the show.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 17, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

801,851. PORTABLE TELEPHONE; Walter N. Clark, Warren, O. App. filed Oct. 1, 1904.

801,864. TELEPHONE SYSTEM; Edward J. Hall, New York, N. Y. App. filed Feb. 8, 1905.

801,888. ALTERNATING-CURRENT MOTOR; Robert Lundell, New York, N. Y. App. filed Jan. 9, 1905. (See Current News and Notes.)

801,895. JUNCTION BOX; Thomas J. Murphy, New York, N. Y. App. filed Sept. 12, 1902. The box is of knock-down construction and is made of sheet metal plates which are secured together by sheet metal corner brackets of special form which interlock with the side members so as to form a rigid structure. The side plates have openings for the entrance of the conduit cables.

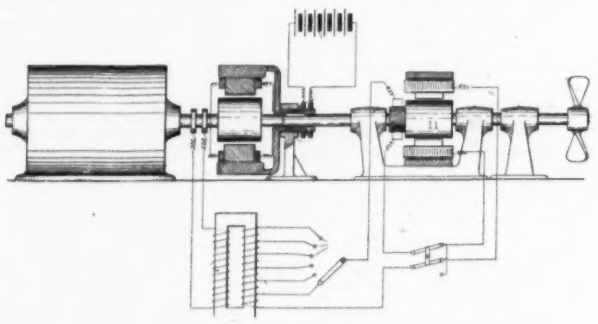
801,898. ELECTRIC POWER TRANSMISSION DEVICE; Herbert McNulta, Anaconda, Mont. App. filed Dec. 10, 1904. In order to secure a perfectly elastic and controllable application of power to the screw propeller of a ship or driving wheels of an engine, the patentee positively drives an armature, the torque from which rotates the fields and the connected propeller or parts. The current generated from the relative motion operates an additional motor to give additional torque to the driven parts. The circuits can be manipulated to vary the control in many different ways.

801,904. ELECTRIC TORCH; John C. Perry, Columbia Station, O. App. filed May 28, 1904. An imitation musket or fire arm with a glass bayonet attached, has an electric lamp therein which can be flashed momentarily by a trigger for spectacular purposes.

801,922. AUTOMATIC SPRINKLER SYSTEM; William C. Shaffer, Milwaukee, Wis. App. filed June 5, 1902. A switch blade is maintained midway between two contracts by connections from two opposed diaphragms when the liquid pressure thereagainst is equal. A preponderance of pressure against either diaphragm moves the switch blade and establishes one or the other signal circuit.

801,936. APPARATUS FOR THE SIMULTANEOUS TRANSMISSION OF TELEPHONIC AND TELEGRAPHIC CURRENTS OVER THE SAME LINE; Carlo Turchi, Ferrara, Italy. App. filed July 13, 1904.

801,939. ELECTRIC ARC LAMP; Egidio Viale, Gross-Lichterfelde, near Berlin, Germany. App. filed June 16, 1904. Mechanical details of an arc lamp which shall not be unduly heated in use. For this purpose ventilating openings are made in the casing, and radiating flanges are disposed to dissipate the heat and at the same time prevent moisture from entering the openings.



801,898.—Electric Power Transmission Device.

801,947. MAGNETIC SEPARATOR; John Price Wetherill, South Bethlehem, Pa., and Henry A. J. Wilkens, New York, N. Y. App. filed Dec. 18, 1897.

801,967. MULTIPLEX SYSTEM OF TELEGRAPHY; George A. Cardwell, New York, N. Y. App. filed Feb. 3, 1900. Messages are transmitted in the usual Morse code in superposed sets or groups, to each of which sets or groups of impulses is given a different meaning at different stations, so that two stations may receive the same impulses, but owing to different translations, have different messages conveyed thereby.

801,999. TROLLEY WHEEL; George Loffi, Norwalk, O. App. filed Jan. 7, 1905. In addition to the usual bearing spindle for the trolley wheel, the inside faces of the harp have cupped recesses concentric therewith which furnish an additional bearing surface for the wheel.

802,015. DEVICE FOR ATTACHING TELEPHONE AND OTHER WIRES TO INSULATORS; Esek McDaniel and Michael Barr, Paris, Ill. App. filed Mar. 23, 1905.

802,020. FOG DISTANCE SIGNALING METHOD; John Patten, New York, N. Y. App. filed May 22, 1903. Upon every ship or vessel is placed an apparatus having means for exploding gun powder under the influence of Herzian or ether waves. Such waves are periodically transmitted from a convenient station on shore so that explosions occur on the different ships simultaneously. Each ship then notes the elapsed time between the sounds and from this data computes the distance between the vessels.

802,032. ELECTRIC COUPLING; Norman Marshall, Newton, Mass. App. filed Oct. 26, 1903. The usual floor plate has openings therein in which are inset vulcanite bushings so that the plugs will be positively guided into their correct position without careful manipulation, or danger of making a short circuit.

802,080. CABLE-HANGER; Gustaf Lambert, Charlottenburg, Germany. App. filed June 8, 1900.

802,093. SYSTEM OF OVERHEAD ELECTRIC CONDUCTION FOR VEHICLES Ettore Bauco, Rome, Italy. App. filed Aug. 20, 1902. The trolley wires are stretched in such a way as to constitute track rails for a small carriage structure having contact wheels, which moves thereon. The vehicle to be propelled has flexible connections with the carriage and draws the same along the trolley wires when in operation.

802,096. TREE INSULATOR; Charles W. Dunton, Boston, Mass. App. filed Mar. 24, 1905. In order to overcome damage to the wires and insulators due to the swaying of trees when the latter are used as supporting means, the insulator is mounted on a swinging arm which allows a swaying movement to take place within certain limits.

802,111. ANNUNCIATOR; Alfred Laurentius Peterson, Clipper Mills, Cal. App. filed Apr. 10, 1905.

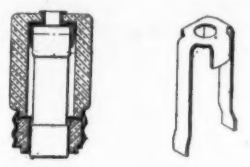
802,130. ELECTRIC MEASURING INSTRUMENT; Montraville M. Wood, Schenectady, N. Y. App. filed May 29, 1902. (See Current News and Notes.)

802,153. PROCESS OF REDUCING METALS AND MAKING ALLOYS; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed Jan. 6, 1905.

802,160. TROLLEY BASE; Charles E. Gierding, Newark, N. J. App. filed Jan. 30, 1904. A rigid stud projects vertically from the roof of the car and constitutes part of a roller bearing race-way for the fixtures which support the trolley pole.

802,170. MAGNETIC ORE-SEPARATOR; Richard R. Moffatt, Brooklyn, N. Y. App. filed July 13, 1904.

802,172. FIRE ALARM OPERATING DEVICE; Osman K. Nestor and Emil Moch, Jersey City, N. J. App. filed May 31, 1905. Thermostat in which springs are prevented from expanding against a metal plate by buttons of fusible substance. When the buttons melt the springs expand and make alarm contact.



802,246.—Electrical Fuse Plug.

802,173. TROLLEY HARP; Edward D. Rockwell, Bristol, Conn. App. filed Mar. 11, 1905. The trolley wheel spindle is removable from the trolley harp in substantially the same way as an ordinary spring shade roller is removed from its fixtures.

802,205. PROCESS OF PRODUCING CHLORATES AND BICHROMATES; Arthur Edward Gibbs, Niagara Falls, N. Y. App. filed Mar. 1, 1904.

802,246. ELECTRICAL FUSE PLUG; George B. Thomas, Bridgeport, Conn. App. filed Mar. 17, 1905. A fuse plug for Edison sockets in which the fuse cartridge itself makes the contact at the central stud, while a sheet metal frame is connected to the threaded shell and extends into contact with the outer end of the cartridge.

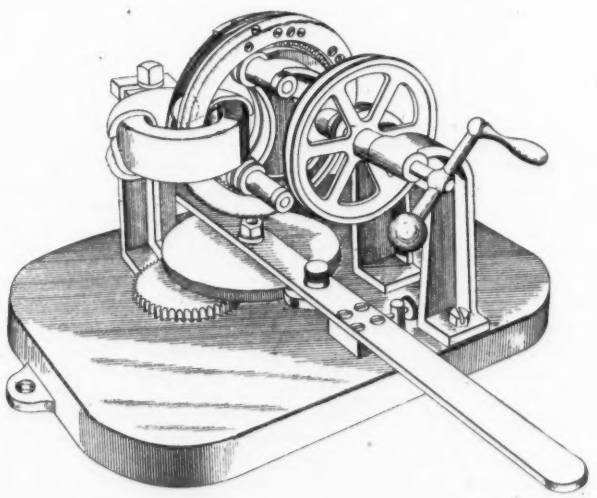
802,266. FIRE ALARM OR SIGNAL; John A. Chase, Denver, Col. App. filed Dec. 16, 1904. A thermostat in which gravity impelled contact is normally restrained by a cord which burns in case of fire.

802,291. MAGNETO-ELECTRIC IGNITION APPARATUS FOR EXPLOSION ENGINES; Gottlob Honold, Stuttgart, Germany. App. filed Apr. 30, 1902. The primary and secondary coils are wound directly on the armature of the generator, and the primary coil is short circuited to oppose the magnetic flux from the fields, and subsequently broken whereby the suddenly increased magnetism causes a jump spark in the secondary armature circuit.

802,305. AUTOMATIC BLOCK SIGNAL SYSTEM; James McIlwain, Okawville, Ill. App. filed Feb. 21, 1905. A railroad signal system in which the locomotive carries a pair of trolley poles and the conductors are so arranged as to give different signals within the cab under different conditions.

802,328. QUANTITY METER; Richard Schmidt, Munich, Germany. App. filed May 13, 1903. A form of coulomb-meter in which the regulator of an ordinary clock is connected to an ammeter so that the clock registers in proportion to the time and the current used.

802,337. MOISTURE PROOF CASE COVERING FOR THE TERMINALS OF LEAD ARMORED INSULATED WIRES, ETC. Charles E. Teush and Luther Hargis, Evansville, Ind. App. filed Mar. 27, 1905. The usual lead sheathes of telephone conduits are bent downard in parallel relation and a cap soldered thereto upon which may be screwed a tubular box which protects the conductors after the connections have been made.



802,359.—Winding Machine.

802,350. WINDING MACHINE; Charles P. Nickel, New York, N. Y. App. filed Apr. 27, 1904. An annular coil-carrying winding frame has an internal gear by which it is turned to wind the wire around a ring-shaped armature core in the usual manner of winding machines. Has gearing for angularly moving the armature as the winding progresses.